ing more pipe, through which the cord passes. In rainy weather, a cover like a buggy top protects the machine.

Scoring has been done by hand in the past, but the new device keeps the result in view of the spectators, a previous difficulty.

TANTALUM DENTAL INSTRUMENTS

Tantalum, a non-metallic substance found in certain minerals, so named, according to Webster's dictionary, because of the perplexity and difficulty encountered by its discoverer in isolating it, is now being used as a material for dental instruments.

A manufactory of such instruments has recently been established. Many advantages, besides lower prices, are claimed for them over the steel instruments. Among these advantages are hardness, freedom from effects of acids —except fluoric acid—and capacity to withstand a high temperature.

Dentists who have used tantalum instruments say they will not rust when left exposed to the air, but retain their polished surfaces, besides proving more lasting than steel. The can be cleaned by washing in so of and disinfected by boiling in watich are taining soda. In working with in the phate and silica cements a diagonal gams, they have special ad

Partially Demolished English Battleship

THE BREAKING UP OF A BATTLESHIP

The H. M. S. "Thunderer," once a great battleship, would hardly be recognizable as a battleship in this illustration, were it not for the guns, partially dismantled. The "Thunderer" saw her first day of service 33 years ago. At that time she was considered a powerful fighting ship, being 285 ft. long, 63 ft. in beam, and displacing 9,330 tons. During the last years of her active service she carried the four 10-in. guns seen in the illustration.

A few months ago she was sold to a ship-wrecking company. It will take 100 men two years to break her up for the material she contains. A great "super-Dreadnought" is to be built to bear her name.

AN ANIMATED WRENCH

A unique method of advertising the type of wrench known as the Stillson was adopted at the recent convention

Ingenious Wrench Advertisement

of the New England Hardware Dealers' Association in Boston. The handle of the wrench was formed by a man, and the movable jaw provided a canopy for his head.

SKYSCRAPER TO BE DEMOLISHED

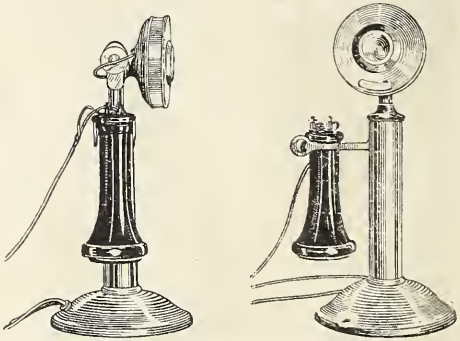
In the eyes of European visitors, one of the most curious of American traits is the apparent joy with which buildings, only recently erected, from a European standpoint at least, are torn down to make way for new. In England Continental countries buildings are constructed with the expectation they will last for all time, or at least until they fall to pieces from decay in the course of several hundred years.

An Englishman approaching the corner of Nassau and Wall streets, New York, during the intended demolition of the 16-story Gillender building, would gasp at the sight of such a perfectly good building being destroyed. The reason it is to be torn down is to make room for a larger and taller structure. It is a steel-frame office building erected in 1896, only 14 years ago, and is one of the most pleasing in appearance of all the New York skyscrapers.

FLUSH MOUTHPIECE FOR TELEPHONES

A flush mouthpiece for telephones has been designed by a New York inventor for the purpose of making the transmitter more sanitary. It consists of an aluminum cup attached to the diaphragm of the transmitter by means of the bolt and nut used in fastening the front electrode to the diaphragm. The cup extends through the transmitter case and its outer edge is turned over so as to come nearly flush with the face of the case. The cup fits close enough to the case to seal its interior from dust and dirt, but does not come in actual contact with it. There are no grooves for the lodgment of dust or dirt.

Tests of the new transmitter are claimed to prove that it gives just as



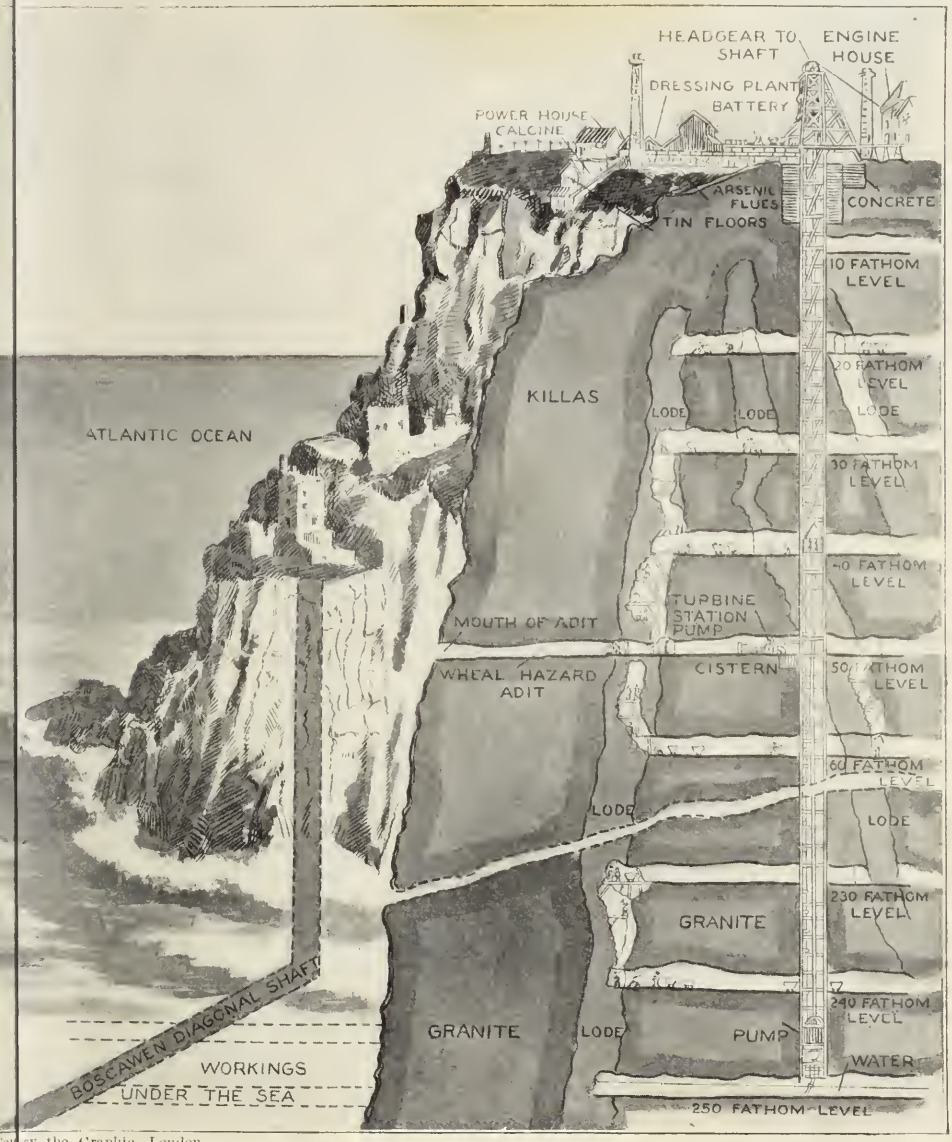
Dirt-Proof Telephone Mouthpiece

good service over distances of from 1 to 500 miles as the cup type now in general use.

INING TIN UNDER THE SEA

everal of the tin mines of Cornwall, gland, have workings extending out ler the Atlantic ocean, one of the a large portion of its workings are under the sea.

The location of the lodes of tin in the cliff, and the method of working them from drives is shown. The same



Courtesy the Graphic, London

Famous Tin Mine in Cornwall

st extensive of which is the Botal- o mine shown in the illustration. It is situated on the most rugged, wild, a picturesque part of the Cornish coast, a few miles from Penzance, and method is adopted in the working of the lodes underneath the sea, which are reached through the shaft shown in the drawing as the Boscawen diagonal shaft.

LLAMAS TRANSPORT CEMENT AND SAND IN PERU

Llamas are used to a great extent in the mountainous parts of Peru as

Llama Transporting Sand

carriers of material for engineering and construction work. The llama shown in this illustration is carrying 100 lb. of sand for use in making concrete and mortar for the construction of a mining, smelting and refining plant. In this particular instance the llamas carried both sand and cement a distance of about three miles over a mountain pass, the owner of the animals receiving seven cents for every 100 lb. of material delivered, which was seven cents an animal per trip.

Llamas are handled in trains of from 30 to 40. They cannot stand steady work and become balky, consequently they usually work two weeks and lay off one. The loads they carry usually weigh 100 lb. If more weight is added they know it, and are quite likely to refuse to move until the excess is removed from their backs. They are stubborn enough at such times to take any amount of punishment rather than give in.

¶A farmer recently invented a device for making concrete water barrels. He put a small wooden barrel inside a larger one, and filled the space between them with concrete.

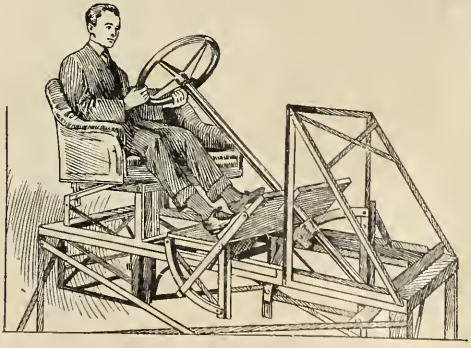
NORTHWESTERN RAILROAD TO STUDY ACCIDENTS

A systematic study of the causes of accidents is to be made by the general claim agent of the Chicago & Northwestern railroad, for the purpose of devising and applying means of prevention. The official will spend most of his time in the future on the road, where he will get employes together, call their attention to means by which accidents which have happened could have been avoided, and conduct a general accident elimination campaign.

FITTING THE AUTOMOBILE TO ITS OWNER

Nearly all of the large automobile factories do more or less custom work in fitting automobiles to their prospective users in very much the same way as a clothier alters ready-made suits or overcoats to fit purchasers. The great difference in the length of arms, legs and body sometimes makes it more comfortable for the owner of a car if the position, distances, and angle of the seat, footboard, and steering wheel are made accordingly.

The framework shown in the illustration is the adjustable means by which one concern makes measurements for such cases. The seat can be raised and lowered, the footboard tilts



Measuring a Man for an Automobile

to different angles, and the steering-wheel rod can be shortened or lengthened.

Uncle Sam's Greatest Reclamation Project Nearing Completion

The Roosevelt Dam, Titanic Structure of Sandstone and Cement, Costing Nine Million Dollars, Will Convert Barren Wastes Into Fertile Acres

By L. W. THAVIS

THE Roosevelt dam, the greatest engineering work in connection with the Salt river irrigation project in Arizona, which ranks first among the works of the United States reclamation service, will be completed in July. Should present plans be carried out, of a 20-story building, it would rise 10 ft. above it, while its length on top would be more than two city blocks. Across its top will be a roadway 20 ft. wide.

The reservoir created by the Roosevelt dam is the largest artificial body of

Cement Plant Built by Government at Roosevelt

former President Theodore Roosevelt will, if he accepts the invitation, formally open the project on his birthday, October 27.

This wonderful structure of sandstone and cement, costing nearly $9,000,000, rises 284 ft. above Salt river. It is 1,080 ft. long on top and 170 ft. thick at the base. Its foundation covers one acre of ground. Placed by the side water in the world. Its capacity is sixty-one billion cubic feet, and if its water were spread over the state of Delaware it would cover the entire surface of the state a foot in depth. Another comparison of its capacity, made by the government engineers, is that it would easily feed a canal 300 ft. wide and 19 ft. deep from Detroit to San Francisco.

This government work is interesting not only to the engineer, but also to the layman. It is located in a valley which has been the abode of three races, one of which lived there when Rome was young. Two wonderful cliff-dwellings are almost in sight of the modern structure that is soon to submerge some of the lands which formerly produced their harvests.

Owing to the remoteness from transportation, the government engineer had to engage in many enterprises. He built roads to get machinery in. He sawed millions of feet of lumber from the national forests nearby. He turned farmer and raised his own produce, his hay, pork, beef, and chickens.

In the construction of the dam 330,000 bbl. of cement was required, but the lowest bid from the cement manufacturers was prohibitive. In this problem the engineer was undaunted. He found a limestone ledge near the dam and proceeded to erect a cement mill. The necessary clay was found a mile away, and a railroad was constructed to convey it to the mill. In manufacturing its own cement the government saved the sum of $600,000 on this project. Power was essential, so a dam was built sixteen miles upstream, turning a part of the river into a power canal.

Sawmills were set up in the national forest, 30 miles away, and several million feet of lumber were cut and hauled to the works. Two farms were cultivated to supply vegetables and provisions, hogs and beef for the laborers. Waterworks and electric light plants were established. A city of 2,000 people sprang up in the valley—a town of transient renown, for it has already nearly disappeared.

For laborers the government turned to the Indians living in the mountains. Though many of them were Apaches, they proved tractable and industrious, and it was largely by their labor that the remarkable highway was constructed.

From the big dam and from drops in the canal 26,000 hp. will be developed. A part of it will be transmitted to the Sacaton Indian reservation to pump water from wells upon 8,000 acres belonging to the Pima Indians—an act of justice long postponed, for the tribe was beggared by the robbery of their water supply by the white men.

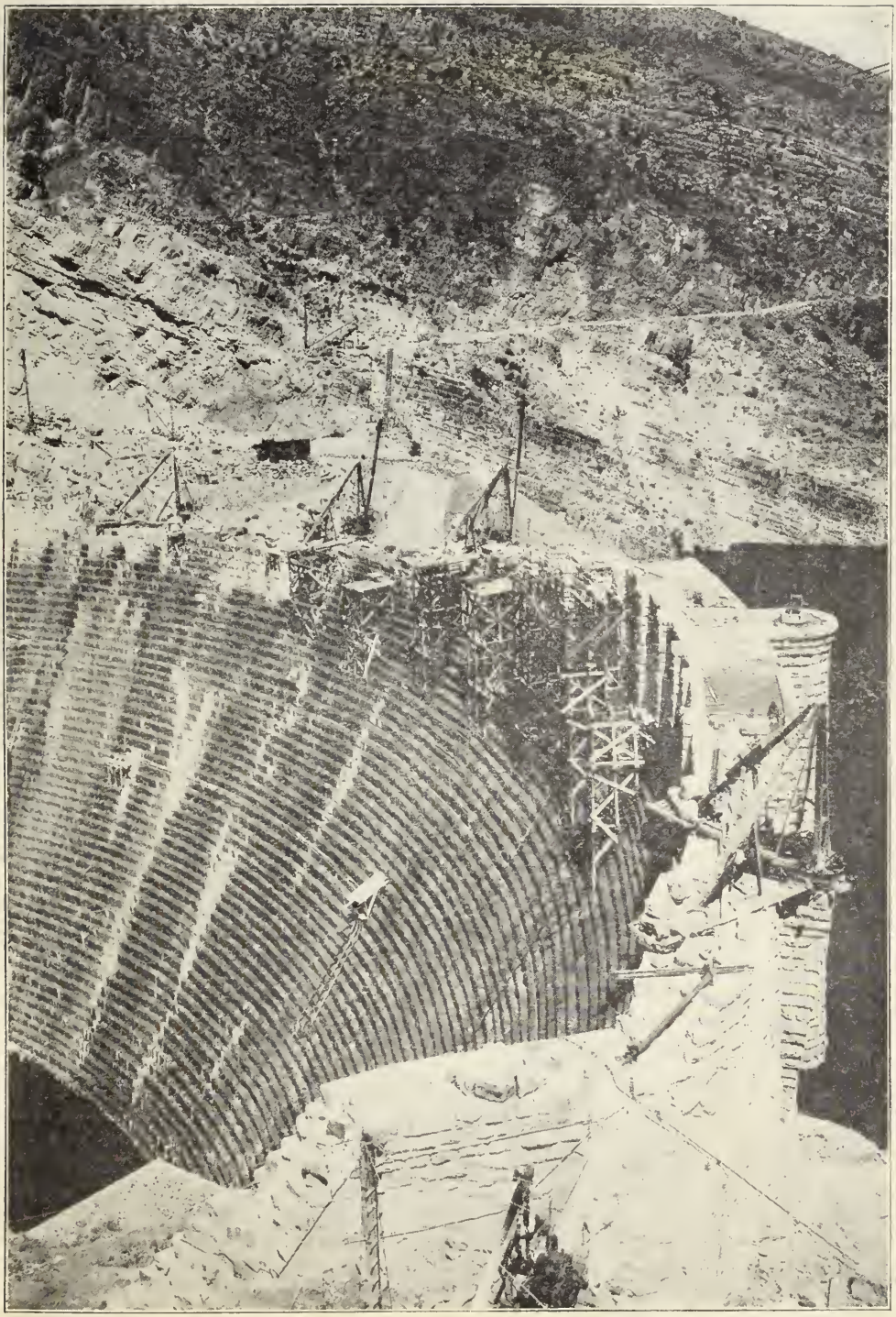
The project when completed will irrigate 240,000 acres of land. It is estimated by expert agriculturists that the crops of a single season will return enough to repay the entire investment of the government.

The acreage now irrigated by the system in operation is 131,000, the balance of 109,000 acres will be irrigated on completion of the Roosevelt dam and the necessary pumping plants in 1911. The irrigated lands in this valley are selling today from $100 to $750 per acre, according to the reclamation service officials. Lands not yet irrigated, but which ultimately will have water right, are selling from $65 to $150 per acre depending upon location, etc.

All lands embraced in the Salt river project are pledged to the repayment of the government's investment. The character of the security is indicated by the present selling value of the land. Taking the lowest unit of land value, $65 per acre, as a basis, the value of the 240,000 acres in the project is $16,400,000, which is practically mortgaged to repay the federal investment of $8,640,000 by less than $1,000,000 annually.

An estimate derived from careful compilation by a special field agent of the department of agriculture places the average value per acre of the crops now grown in this project with insufficient water supply at $39.60. In other words, a single annual harvest from this valley, when all the lands are in cultivation, will more than equal the cost of constructing the whole Salt river project.

Arizona is America's Egypt, but, unlike the land of the Pharaohs, whose secrets are revealed to us in hieroglyphics which our wise men have learned to read, the history of the ruined cities of the Southwest and the race that built



Looking Down on Roosevelt Dam

View of the Dam Showing Position in Canyon

them is yet unfathomed, despite the persistent research of archeologists and other interested persons.

This is our land of mystery and enchantment, where nature has painted the landscapes with the rainbow's hues. It is the land of the painted desert, with its inspiring scenery and colors; it is the land of the Grand Canyon, Nature's architectural masterpiece, the Titan of chasms; the land of the meteoric mountain and the petrified forests. With resources of soil, minerals, and forests as varied as the wonderful colors of the landscape; with every gradation of climate from north temperate to semi-tropic; with an area double of New England and a population less than that of the city of Washington, Arizona is yet practically undeveloped and almost unexplored.

Over its vast expanses of divinely tinted desert wander the Bedouins of the United States. Here and there on the higher mesas, or beside the deeply eroded waterways, dwell the strangest people on our continent. This land of mystic dreams, of lost races and crumbling ruins, is awakening to the touch of modern civilization. The streams that once swept on unchecked through gorge and canyon are now being spread upon a thirsty land, and emerald-tinted oases are dotting landscapes which for ages were barren and desolate.

After the long and dusty ride across Arizona the traveler who awakes in Phoenix in the early morning feels transported into a new world. He is in a land where vegetation is almost tropic in its splendor and luxuriance. Here are avenues of palms whose spreading branches bend in graceful curves. Here the orange, the lemon, the olive, and the pomelo attain perfection in color and flavor. The date palm, laden with luscious fruit, the bread of the desert; the delicious fig, the almond, and countless other donations of generous nature are seen on every hand. Broad fields of alfalfa, yielding eight tons to the acre; bumper yields of grain, vegetables, and small fruit reward the man with the hoe in this land of sunshine and plenty. The soil's response to tillage and moisture is immediate—yea, it approaches the miraculous.

But earth grants no harvest here without labor and expense. The desert, vast and forbidding, is near and threatening. Its threat of desolation is vitalizing; it energizes the man who engages in the combat. It thrusts its boundaries to the very edge of the irrigation canal which embraces the oasis. More than once in early days, when Salt river failed, the desert swept across the ditch and engulfed the fields and orchards. Such disasters emphasized the need of an assured water supply and led to the initiation of one of the most stupendous irrigation projects of our time in Salt river valley.

In the variety of the engineering problems, in the magnitude of the works, and in the extraordinary character and number of difficulties surmounted in prosecuting the work, the Salt river project ranks first among the works of Uncle Sam's reclamation service.

A few of these difficulties are made manifest by an inspection of the country in which the work is going on. The Salt river for a number of years furnished an inadequate supply of water for the needs of the farmers. At times great floods destroyed important headworks and caused heavy losses until the necessary repairs could not be made for lack of money. Near the headwaters, in an almost inaccessible mountain region, was one of the best natural reservoir sites in the West. To develop it involved an expenditure so vast that it was beyond the means of the community to attempt it. Congress enacted the reclamation law and the reclamation service took up the great work.

For 20 miles across a desert of cacti and mesquite, an absolutely waterless plain, a broad highway was laid out to the foot of the mountains. For 40 miles further into the most rugged mountain country in the West the road was blasted from the rocks.

In scenic beauty and in artistic and changeful coloring no highway in the

West compares with it. The mountains are inspiring and the rocks are clothed in richest colors. No language can describe the glories of the sunrise or sunset pictures on those crags and cliffs, or the witching beauty of the deep canyons veiled in purple shadows. It is a drive, once taken, never to be forgotten.

The entrance to the canyon which Salt river has cut through the mountains was selected as the site for the Roosevelt dam.

32 to a train, would make the 22 trains shown in the illustration. Yet, this amount of coal, which, in the drawing, looks as if it would completely fill the ship, occupies but a small proportion of the space. It is hidden deep in the bowels of the leviathan, below the 700-ft. water-line of the hull.

If it were possible to discharge the coal into the ship by the aid of great cranes the task would take only a few hours, but this method would expose the entire ship to clouds of coal dust.

Coal for One Trip

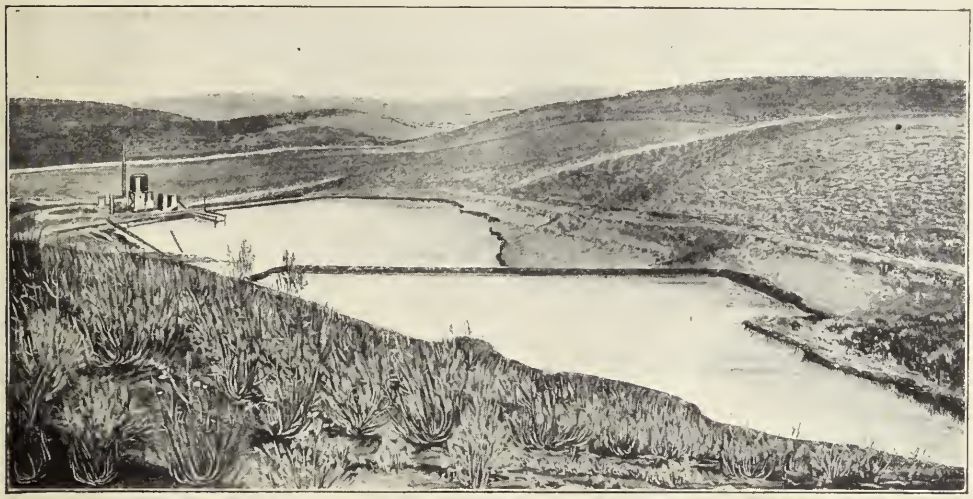
COALING THE "MAURETANIA" IN ENGLAND

The coaling of either of the great Cunarders, which will hold the record of being the largest vessels in the world until the completion of the two White Star monsters, is a tremendous task, made all the more difficult because care must be taken to keep coal dust from flying.

Just how much coal is required for a journey across the Atlantic is graphically shown by this illustration used through the courtesy of the Sphere, London. The amount of coal necessary is 7,000 tons. It is taken to the Mersey docks in small coal cars of 10-ton capacity. These cars, allowing

Consequently, the cars of coal are discharged into low, flat barges and towed in long rows alongside the ship. Just on the water-line a number of oblong doors are thrown open, and through these the coal is shoveled into the dark caverns by hundreds of men, working night and day until the task is completed.

"When the number of all those who are directly employed in the process is found and multiplied by those dependent on them or who make their living by catering to their wants," says the Sphere, "it may be assumed that for every 1,000 persons crossing the Atlantic the strenuous labor of 10,000 and probably the livelihood of 20,000 must be involved."



A Pond of Oil in California

STORING OIL IN PONDS

To those whose one idea of oil storage is in huge tanks, this illustration will be interesting. It shows 15,000 bbl. of oil in storage on the property of the Templor Ranch Oil Co., in California. Viewed from the hills in the distance the oil ponds might be taken for the kind of muddy ponds of water frogs delight in.

MOVING-PICTURE SHOWS PROPOSED FOR TRANS-ATLANTIC LINERS

The suggestion has been made by persons interested in the moving-picture industry that shows for the benefit of the steerage passengers be given on the trans-Atlantic liners. Thousands of such travelers arrive in America every week, and the six or seven-day voyage sometimes becomes quite tedious. The first and second-class passengers, according to the Moving-Picture World, might also find such shows on steamships interesting.

¶Eighty-three vessels met with disaster and 225 persons perished by shipwreck off the New England and British North American coasts during the fall and winter of 1909-1910.

SUGGESTED FAD IN WALKING-STICKS

A writer in Black & White, a London magazine, suggests that the handles of walking-sticks for unmarried ladies should bear the carved likenesses of the admirers paying them court. At each

Courtesy
Black and White

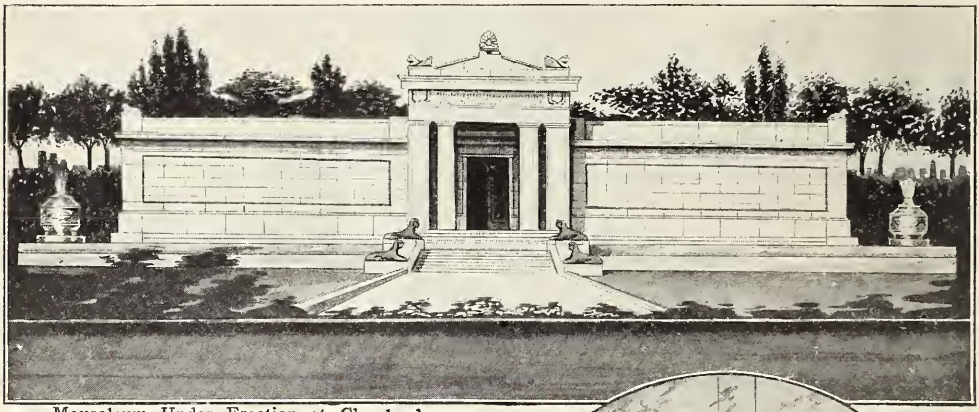
Admirers as Walking-Stick Handles

addition to the catch, a new stick should be ordered carved, but, so advises the writer, the collection should be burnt before marriage.

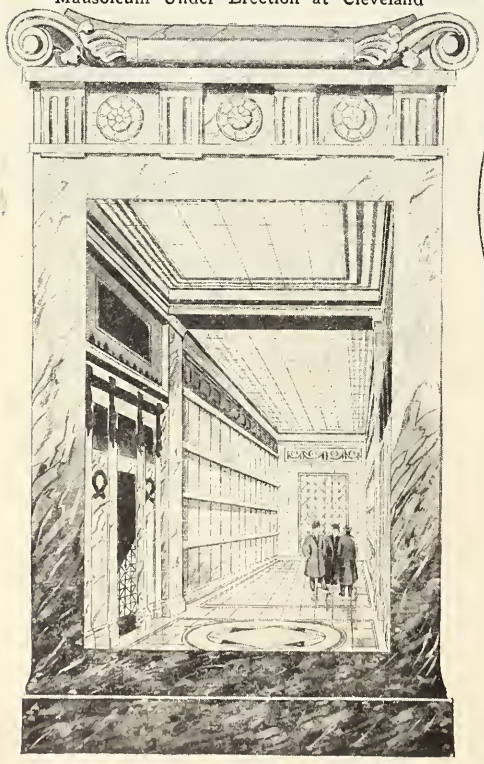
CONCRETE MAUSOLEUMS

Two fine examples of modern mausoleums, one being erected in Brooklyn Heights cemetery, Cleveland, Ohio, and the other to be built in Roseland Park cemetery, Detroit, Mich., are shown in these illustrations.

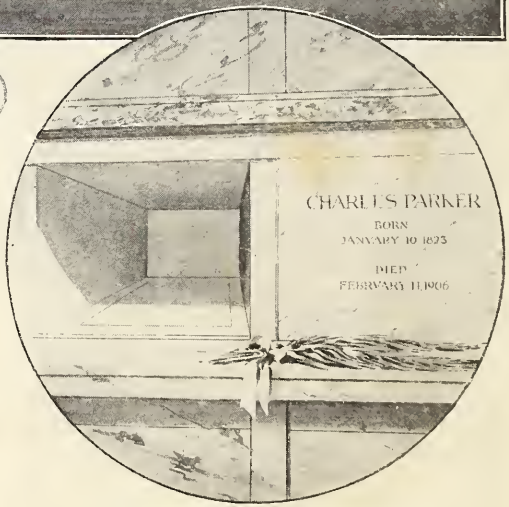
The former is of solid concrete throughout, except the interior lining of marble, and is 133 ft. wide, 32 ft. deep, and about 30 ft. high at the entrance. A main corridor provides access to 400 crypts. The crypts are 2½ ft. wide, 2 ft. high, and 7½ ft. long. When the casket is set in place a marble slab is hermetically sealed into place over the opening. The name of the deceased and such other information as is desirable is carved upon the slab. The illustrations show the exterior appearance, the corridor, and an open and closed crypt.



Mausoleum Under Erection at Cleveland



Corridor of Cleveland Mausoleum



Concrete Crypt in Cleveland Mausoleum

The mausoleum proposed for Detroit is of Roman architecture, and will be,

Courtesy Concrete

Mausoleum to be Erected in Detroit

it is claimed, the largest and most expensive building of its kind in the country. The structure will be two stories high, the outside wall being of reinforced concrete, surmounted by a concrete roof. An inner wall of solid concrete will be separated from the outer wall by a 12-in. air space. The floor arrangement, with its long middle corridor and the solid concrete columns, is shown in one of the illustrations. The middle corridor is open from the first floor to the roof. Access to the crypts on the second floor is made possible by the balconies between the crypts and the columns.

The structure is to be built under certain patents governing new methods of caring for the dead. The crypts will be drained by concrete conduits leading to quick-lime beds under the building. Formaldehyde tanks in the upper portion of the building connect with each crypt by conduits that automatically release the formaldehyde for the purification of the air.

¶Artificial rubber pavements, over which iron-shod vehicles can be run, thus confining motoring costs to gasoline and oil, is the delightful prediction of an English auto enthusiast.

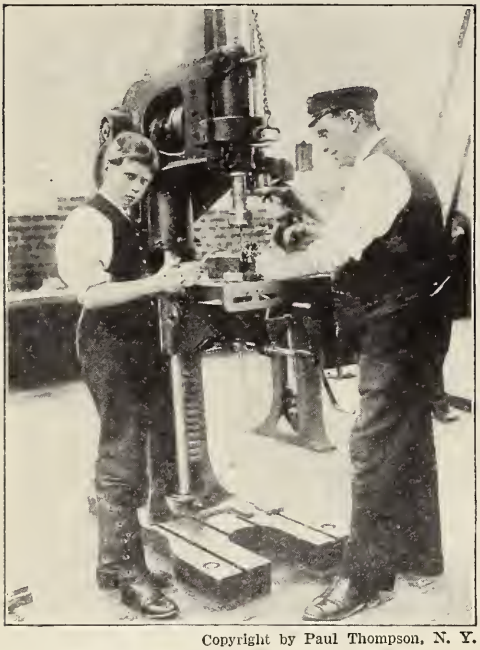
IMITATION SPIDER-WEB VEILS

The appearance of a woman's face covered with one of the imitation spider-web veils being worn to some extent both abroad and in America, is shown in this illustration. The imitation spider on the veil between the eye and ear takes the place of a court-plaster beauty spot.

Face Covered with Spider-Web Veil

BRITAIN'S CROWN PRINCE A CLEVER MACHINIST

Prince Edward of Wales, oldest son of King George V, of England, who be-



Copyright by Paul Thompson, N. Y.
Prince of Wales and Instructor at Work

came crown prince on the ascendency of his father to the throne, following the death of King Edward, is receiving an education which is calculated to give him an insight into every point of the government service. King George was trained as a naval officer and has mapped out a similar course for Prince Edward. He is at present a cadet at the naval school at Dartmouth. He is not afraid of getting his hands dirty working in the machine shops, and has become a skilled machinist.

OLD LACE REPRODUCED IN JEWELRY

Even the intricacies of the lovely old-lace patterns handed down by the lace workers of Brussels and Buckinghamshire are reproduced by the modern jeweler. This class of work, according to an article in the Keystone, has revolutionized his trade, as its delicate nature means that quite as much money is expended upon fine workmanship as upon the jewels themselves.

Jeweled lace effects are now very popular in the European capitals, along with wonderful bows and plaques of precious stones mounted upon gunmetal net, or diamond net. Jewel tracery is so difficult and tedious that four beautiful specimen necklaces composed of oblong pieces of diamond tracery, measuring only three-quarters of an inch in length, were recently sold for $2,000 each.

The latest plaques take the form of wreaths, sprays, and little baskets filled with diamonds and pearls, leaves and flowers.

THE "URSULA" RUNNING 43 MILES AN HOUR

The world's official record for speed on water was broken at the recent motorboat races at Monaco by the Duke of Westminster's powerful racer "Ursula." This wonderful racing craft made an average speed of 43 miles an hour over a course about 4 miles in length. She is 50 ft. long, and her power plant consists of two 400-hp. engines, giving her a total horsepower of 800.

The Fastest Boat in the World

TEACHING OUR BLUEJACKETS TO SWIM

Rear Admiral Schroeder, while training the men on his fleet down in Guantanamo bay, has discovered that some 2,500 of them don't know how to swim, and he reports to Washington that he has taken measures to remedy this defect in their nautical education.

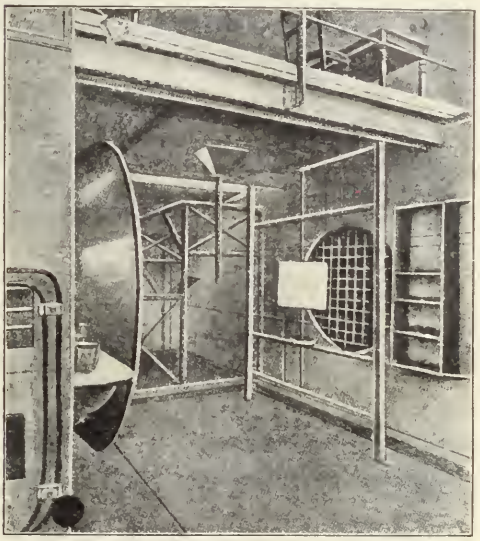
It seems rather remarkable that sailors, with large amounts of water always conveniently near, should lack an art which so many landsmen possess, especially as it is an art the possession of which a sailor is at any moment likely to be in more or less desperate need. It is a fact, however, that seamen as a class swim badly or not at all, and the reason is not far to seek, for, when one comes to think about it, a ship in motion is about the worst thing in the world from which to go in swimming, and the sailor's opportunities for taking to the water, except by an accident, are much less numerous than those of the men ashore.

Moreover, old sailors have been known to argue that since for them falling overboard usually means death, whether they can swim or not, it is better to lack a knowledge that only serves to prolong a hopeless struggle with the merciless waves. That, of course, is bad logic, but it has just enough of truth in it to create something of plausibility to the claim.

AERODYNAMIC TESTING MACHINES ABROAD

The air has undoubtedly been conquered by the flying men in the past couple of years, but that aerial flight is in a measure still in its infancy is being recognized to such an extent that great machines for the study of aerodynamics have been erected in England and France. Tests leading to a better understanding of the actions of the air are being continually made and the fund of scientific knowledge is growing apace.

The scientific end of military aeronautics in England is cared for by the National Physical Laboratory at Ted-



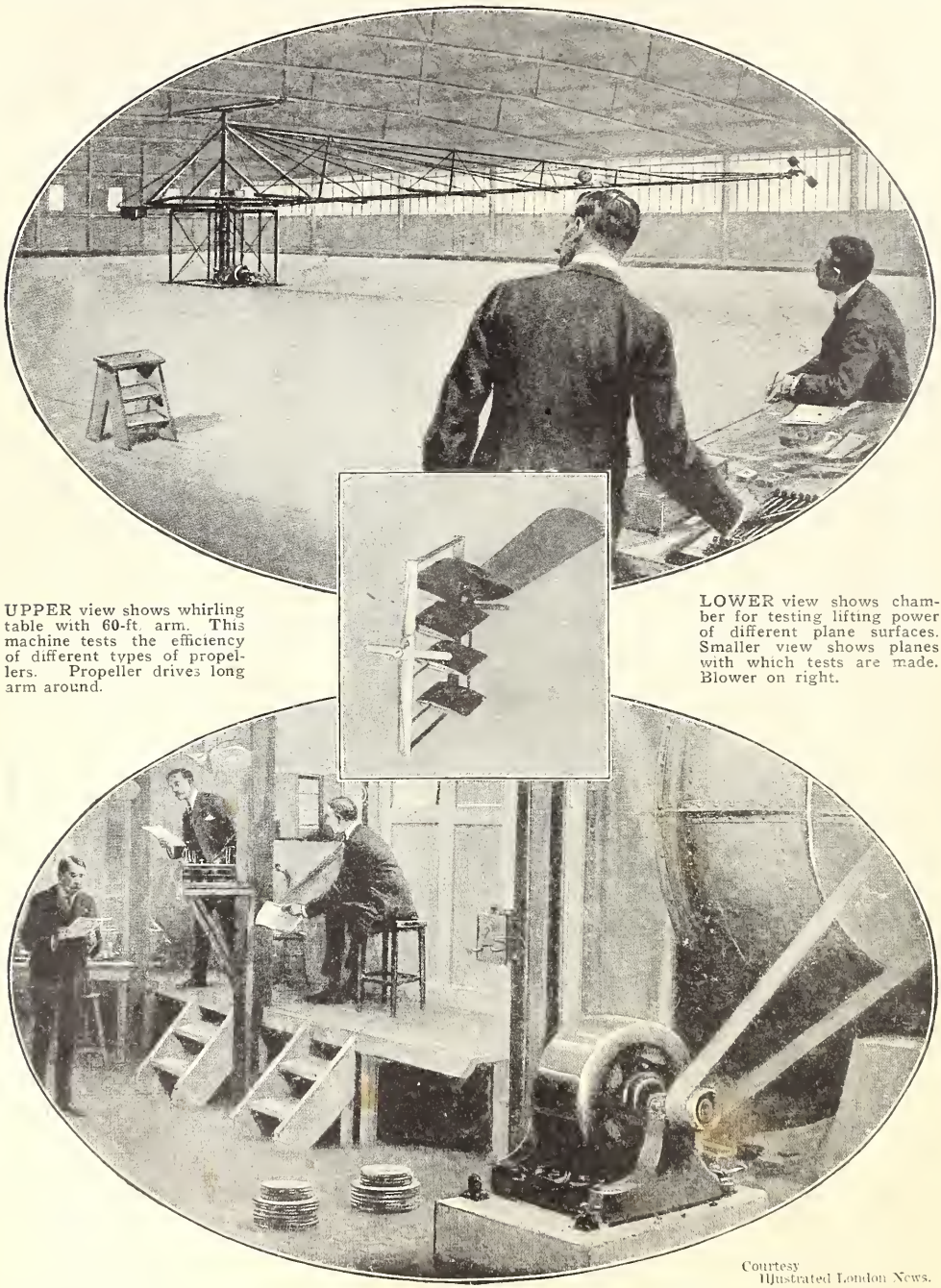
French Wind Mechanism for Testing Planes

dington, where many testing machines are operated by a committee of well-known scientific men. One of the most interesting mechanisms is a chamber in which various plane surfaces are tested for resistance in air currents of known pressure. The artificial wind is supplied by a powerful fan driven by a dynamo. A delicate set of recording instruments shows the lift and drift of each body in the current. Two of the illustrations show the experimenters watching the effect of a 30-mile-an-hour wind. The planes arranged for testing in the air-chamber are also shown.

Another device depended upon for scientific data is the great whirling table, with its 60-ft. arm, at the end of which different types of propellers are mounted to test their "thrust." This is also shown in one of the illustrations. The man in the foreground is turning on the electric current.

France also has machines for experimenting with wind pressures, one of which is illustrated. This is in the lab-

oratory of M. Eiffel. The air is driven through a cellular diaphragm, the rim of which is shown at the left of the illustration, and which strikes against the plane and goes out through the cellular circular opening in the wall on the right. The cellular arrangement is to insure parallelism of the air currents.



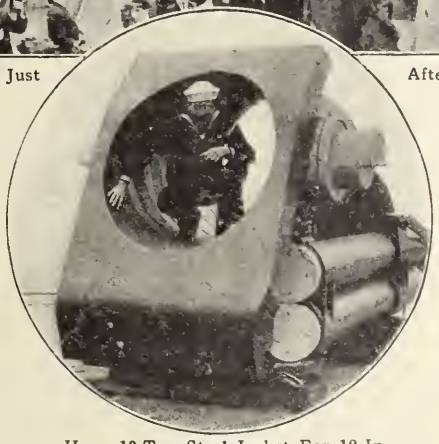
UPPER view shows whirling table with 60-ft. arm. This machine tests the efficiency of different types of propellers. Propeller drives long arm around.

LOWER view shows chamber for testing lifting power of different plane surfaces. Smaller view shows planes with which tests are made. Blower on right.

Courtesy Illustrated London News.

THE LAUNCHING OF THE U. S. S. "FLORIDA"

U. S. S. "Florida" Just After the Launching



Huge 10-Ton Steel Jacket For 12-In Rifle of "Florida"

Although the "North Dakota" and "Delaware" have held the distinction of being the most powerful American battleships afloat, that honor was lost to them in May when the "Florida" was slipped into the water at the Brooklyn navy yard.

The "Florida" was about 68 per cent completed when she left the ways and her dead weight was slightly in excess of 9,000 tons, making her the heaviest vessel ever launched in the United States. The fact that there is no drydock at the navy yard big enough to accommodate her made necessary the completion of many details while still on the ways that are usually done after the launching. Her propellers, rudder, and much of her armor was in place, also all of her boilers and most of her machinery.

This newest and greatest of American fighting ships is 510 ft. long, has a beam of 85 ft., will have a displacement of 21,825 tons, and is expected to make a speed of at least 24 miles an hour. Her propelling machinery consists of turbines. The main battery comprises ten 12-in. guns and sixteen 5-in. rapid-fire guns.

During construction, the weight of the ship was carried upon the keel blocks and upon hundreds of shoring timbers. A few minutes before the actual launching, the weight was transferred from the central keel blocks and the shoring timbers to two parallel lines of launching ways. Each of the permanent ways, built up of heavy square timbers, presented a sliding surface, 4 ft. wide, extending the whole

length of the ship and a considerable distance into the water. On top of the permanent ways were the launching ways, which were attached to the hull of the ship and moved with it down into the water. Between the under surface of the launching ways and the upper surface of the permanent ways was a thick coating of grease and oil. Crushing timbers, provided throughout the entire length with a series of oak wedges interposed between them and the launching ways below, were attacked by hundreds of men about half an hour before the actual launching, and the wedges were driven home, eventually lifting the hull sufficiently to clear the keel blocks.

The final moment came when, at the word of command, carpenters, armed with cross-cut saws, commenced to saw through timbers holding the launching ways from starting down the permanent ways. When the sawing reached a point where the strength of the timbers could no longer hold the vessel, it started, slowly at first, and then more rapidly for the water.

TAKING MOTION PICTURES OF THE MOUNT ETNA ERUPTION

No task seems to be too difficult or hazardous for the motion picture photographer. Often they risk their lives for the sake of securing a thrilling subject to delight the millions of persons all over the world who take pleasure in watching the strange and unusual scenes brought from distant corners of the earth.

The illustration shows two photographers training their apparatus on the belching crater of Mount Etna during the recent eruption. They are located on a neighboring hillside. Despite the dense clouds of suffocating smoke which enveloped them, they, with their native guide, remained until the work was accomplished.

Photographers Working Under Difficulties at Mt. Etna

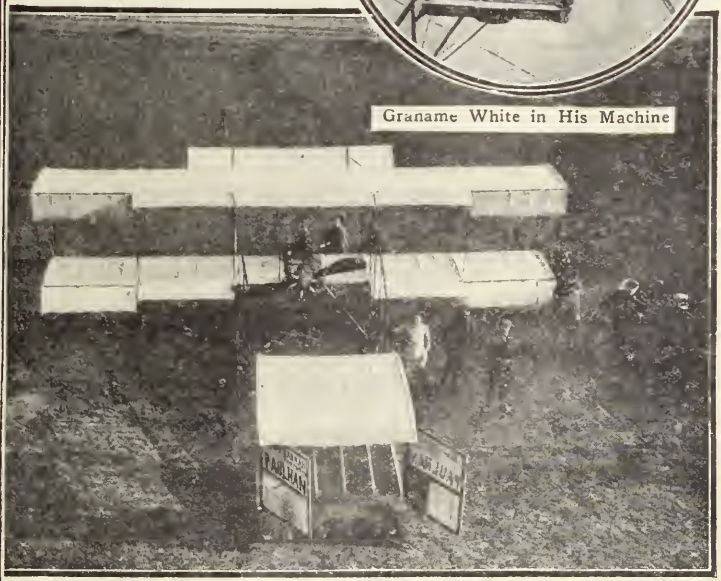
¶The English Channel was crossed for the second time by an aeroplane on May 21st, when Count Jacques De Lesseps, a French aviator flew from Calais to Dover.

¶That the telescope and marine and field glass business received the greatest boom in its history during the recent comet excitement, is the report of the large dealers.

Paulhan Soaring Over Railway Line at Lichfield in the Early Dawn

Grahame White in His Machine

Louis Paulhan



The Farman Biplane in Which Paulhan Made the Prize-Winning Flight

THE RECORD-BREAKING LONDON-MANCHESTER FLIGHT—By accomplishing the flight between London and Manchester, England, in April, for which the London Mail offered a prize of $50,000, Louis Paulhan, the French aviator wrote his name indelibly on the pages of the history of aeronautics. Grahame White, his English rival, won honor by his plucky attempt.

THE ULTIMATE UNIT OF ELECTRICITY

By FRANCIS J. SCHULTE

THAT most powerful and terrible and yet most beneficent of Nature's forces which we call electricity is at the same time the most mysterious. Inspiring at first only terror, then speculation, and finally experiment, its phenomena have been mastered by science and subjected to man's dominion so that now awe has given place to wonder and fear to gratitude. For it gives us not only light, heat and power, but transmits also sound and intelligence, and awaits only the further efforts of inventive genius to shower still greater benefits on humanity. It is the physical manifestation of divine power over life and death, and yet it is servant as well as master of the world.

Prof. Robert A. Millikan, the Man Who Isolated the Ion

What this mysterious force does for us is known; what more it may do is subject for endless speculation and experiment; but what it is has always been a mystery. The generation before this lived in the age of steam. What steam is was known then as it is now. We of today live in the age of electricity, but to this hour no man has yet been able to answer the oft-repeated question: What is electricity? While scientists have been able to harness this mystic force they have all had to admit that they know little about what it is or whence it comes.

The ion is the smallest, the most minute particle or atom in that hitherto imponderable power. The term was introduced by Faraday to denote the current-carriers—the ultimate units bearing the electric charge, either positive or negative. Until this year of grace 1910 nobody had been able to determine accurately the size and character of these units. It remained for Prof. Robert A. Millikan of the University of Chicago, to discover, after four years of study and experiment, that for which scientists have been searching for ages. As a result the world may now confidently anticipate at an early day the unveiling of the mystery—the actual discovery of electricity—for Prof. Millikan has not only reduced the unknown to the ultimate unit, but has measured and observed it, not once only, but repeatedly.

The announcement of this great discovery was made on Wednesday, May 25, to the Sigma Chi Fraternity, the graduate scientific research society of the University of Chicago. In addressing that body, and after giving credit to Mr. Harvey Fletcher, who for five months had assisted in the experi-

ments which have resulted so gratifyingly, Mr. Millikan said:

"1. We have succeeded in isolating an individual ion, and holding it under observation for an indefinite length of time—an hour or more if desired.

"2. We have been able to give a very tangible demonstration of the correctness of the view advanced many years ago that an electric charge is not a homogeneous something—a 'strain in the ether' or an 'imponderable fluid'—spread uniformly over the surface of the charged body, but that it has a definite granular structure, consisting, in fact, of a definite number of specks or atoms of electricity, exactly alike, peppered over the surface of the charged body. It follows, of course, that an electric current, which is simply a charge in motion, consists of a movement of these atoms of electricity through or over the conducting body. This is not asserting anything about the ultimate nature of electricity, but is merely pushing the unknown down into these ultimate electric units or atoms. As a matter of fact, we are pretty certain that all material atoms contain as constituents these ultimate electrical atoms, and it is the vogue now to surmise that these electrical atoms are the ultimate units out of which all matter is built up.

"3. We have succeeded in making a very precise measurement of the value of this ultimate or elementary electrical charge and find it to be 5.13x10 of our absolute electrostatic units. We think this value cannot be in error by more than one-half of one per cent.

"4. We have been able to bring forward new, direct and most convincing evidence of the correctness of the kinetic theory of matter, for we have not only shown directly that a molecule of air is in rapid motion, but we have measured the order of magnitude of its energy of agitation and find it to agree with the computations based upon the kinetic theory.

"5. We have been able to prove that the great majority of the ions of an ionized gas of both positive and negative sign carry one single elementary electric charge, but we have strong evidence that some of these ions carry multiples of the elementary charge.

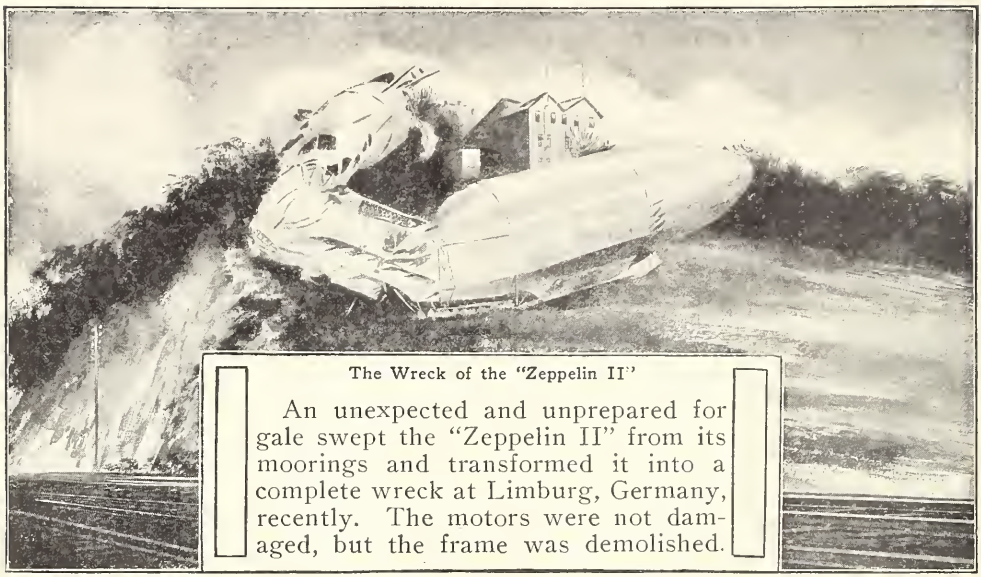
"6. Our results demonstrate in a new way that the negative ion in air is considerably more mobile than is the positive ion. This means that its velocity of agitation is greater and that it moves faster under the influence of an electrical field.

"Our results show that the law of fall of a droplet through a resisting medium, commonly known as Stokes' law, breaks down for droplets whose radius is less than .00026 centimeters. The results further show in just what way this law breaks down."

Prof. Millikan, who was born 42 years ago at Morrison, Ill., and who consequently is now in the prime of life, appears even younger than his years, as will be seen from the portrait printed herewith. He is a graduate of Oberlin College and obtained his doctor's degree from Columbia University, New York. Later he devoted several years to special studies in physics at the Universities of Goettingen and Berlin. He is now associate professor of physics at the University of Chicago and resides with his wife, who is deeply interested in his work, and their two bright little sons, near the institution in whose laboratory—Ryerson Hall—he made his great discovery. He is a very modest man, and averse to talking about his work except before his classes.

The apparatus with which Mr. Millikan made his fruitful experiments is very simple and occupies but little space in the Ryerson Hall laboratory. Describing the method by which his results were obtained, he said:

"We blow a cloud of fine oil of mercury drops by means of an atomizer and introduce one of these drops through a pinhole into the space between the plates of a horizontal air-condenser. The droplet there catches one or more of the ions which normally exist in air or which have been produced in the space between the



The Wreck of the "Zeppelin II"

An unexpected and unprepared for gale swept the "Zeppelin II" from its moorings and transformed it into a complete wreck at Limburg, Germany, recently. The motors were not damaged, but the frame was demolished.

plates by any of the usual ionizing agents, like radium or X-rays. The time of fall of this droplet through a measured distance is observed when no electrical field exists between the plates. Then a field of strength between 3,000 and 8,000 volts per centimeter is thrown on and the time of rise of the droplet under the influence of this field through the same distance is again measured. This operation is repeated and the speeds checked an indefinite number of times, or until the droplet catches a new ion, when its speed under the influence of the field instantly changes, though the speed under gravity remains constant. From the sign and magnitude of the change in speed the sign and exact value of the charge carried by a captured ion is determined."

CURTISS FLIES FROM ALBANY TO NEW YORK

On May 29th Glenn H. Curtiss flew from Albany to New York City in an aeroplane, a distance of 137 miles, winning a prize of $10,000 offered by the New York World. Curtiss made the flight in 2 hours and 32 minutes, an average speed of 54.06 miles an hour, which exceeds the average speed of most of the fast express trains.

The aviator outdistanced a special

Glenn H. Curtiss

express train that started out to accompany him on the trip.

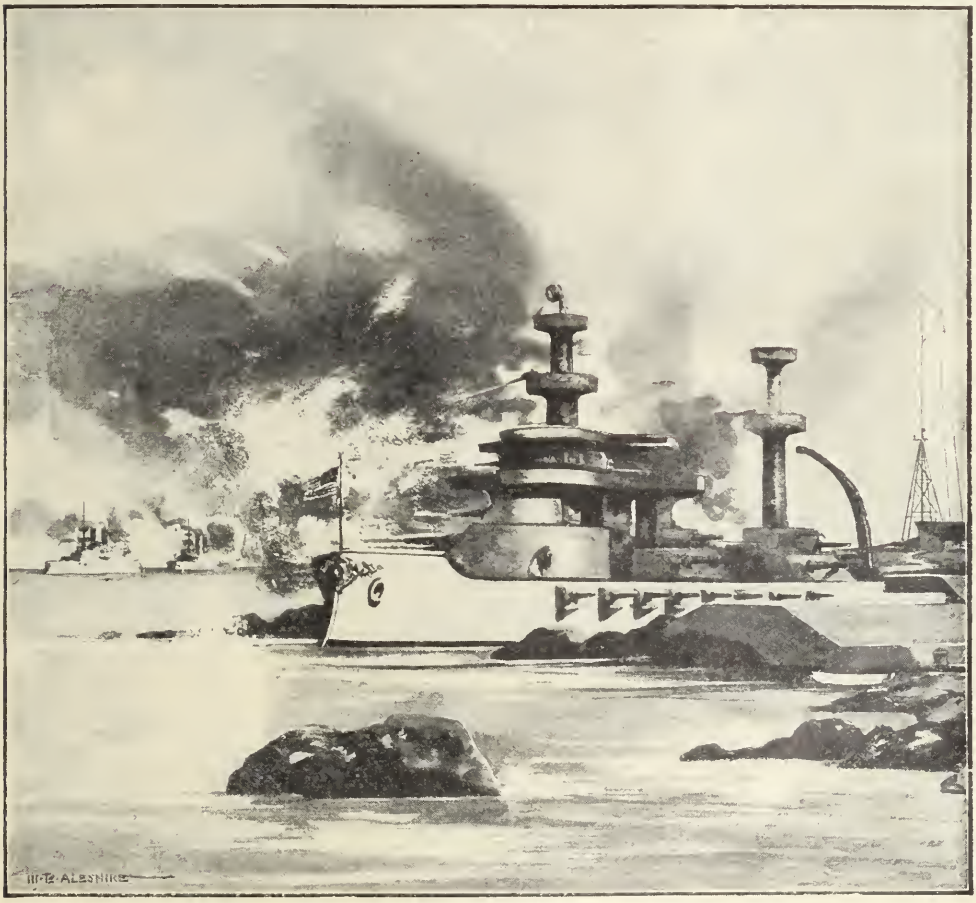
Curtiss made one descent, at Poughkeepsie, where he stopped for an hour.

SHALL OUR OLD FIGHTING SHIPS GO TO THE JUNK PILE?

THE disposition of about 30 ships which have been made practically obsolete as modern fighting ships by the rapid development in the construction of naval vessels and the increased efficiency of the more recent guns, has confronted the navy department with a perplexing problem.

Suggestions for the utilization of the craft are not lacking, for Secretary of the Navy Meyer has many kind advisers on the question. But up to date the secretary is still racking his brain for the solution.

"Sell them for private yachts," was the advice of one member of congress. If there is anyone in the country who pines for an armored cruiser as a yacht, he could undoubtedly negotiate for the purchase of one of the vessels, but strange as it may seem, the navy department has not been overwhelmed with proposals of this kind. Nobody seems to hanker after a yacht which would take a crew of two or three hundred men to run it. Then again, the fuel bill of the proud owner of the cruiser-yacht would be quite a husky



A Battleship Planted in Accordance with Suggestion of Commodore Beehler

one, not to speak of the expense of feeding such a crew, keeping the old craft in repair, and other little incidentals.

The use of a few of the vessels as training ships will undoubtedly dispose of some of them, but that helps only a little. The suggestion which sounds the most practical of any is the utilization of the more powerful ships as forts, stationing some of them in the approaches of important harbors, and planting others on convenient resting places such as small islands, at the mouths of harbors. Where no such places are available it has been proposed to construct small islands around them.

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The Famous "Oregon"—May Be Planted as a Fort

This idea has been approved by Commodore W. H. Beehler, U. S. N., and Congressman Richard P. Hobson, who was, until his resignation from the navy department to enter congress, one of the most able of our naval constructors.

The former declares that Key West, Fla., might be protected by vessels planted on the shoals lining the harbor approaches. He points out that in place of high hills or a huge rock as at Gibraltar, for the mounting of coast defense guns, Key West harbor, 25 miles in length, is sheltered on the north by a line of low reefs and shoals which form a complete protection on that side, while seven miles to the south of this line there is a parallel line of eastern shoals, some of which are scarcely awash at low tide, and none more than 8 ft. above high water. To build forts on these outer reefs would be so costly that it could scarcely be considered, but Commodore Beehler proposes to take our monitors and older battleships which have passed their period of usefulness on the high seas, mount them in selected positions upon these reefs, and utilize them as permanent turret forts. Thus, for instance, selecting the shoal known as Rock Key, where there is a small natural harbor, he would lighten the old monitor "Amphitrite" by the removal of her propelling engines, haul her into the harbor, build around the vessel a dike of piling, rock and riprap, and then fill in the space between the inner face of the dike and the ship with material hydraulically dredged and deposited. He estimates that the work would cost not more than $50,000, and he claims that the seacoast defences would then be increased by a double-turreted fort containing four 10-in. breech-loading rifles, and provided with admirable protection.

The vitals of the fort, that is, the

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Would You Like This Warship as a Private Yacht?—It Is the "Texas"

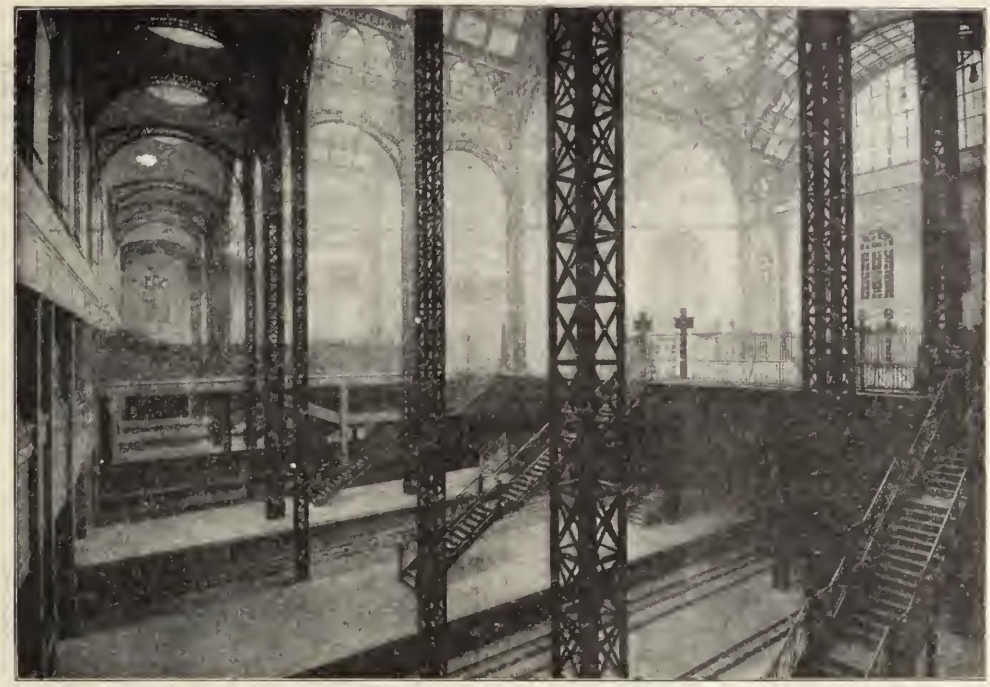
ammunition rooms, turret-turning gear, etc., would be protected, not only by the armor of the ship, but also by many feet of the enclosing earth and riprap. The deck of the monitor would be about 8 ft. above mean low water, and the riprap would be carried up the sloping face, leaving only the turrets and superstructure exposed. The ship, as thus embedded, would furnish, says the Commodore, a complete, modern, double-turreted fort, with every necessary feature to operate the guns, and with quarters for the officers and men of the garrison. And, moreover, the entire cost of the installation would be less than the cost of maintaining such a ship in the navy for one year. The monitors "Miantonomoh," "Terror" and "Puritan" could be installed upon the adjacent reefs, and the range of the sixteen 10-in. and 12-in. guns of these forts would command a large part of the Straits of Florida, and especially that part which is used by westbound vessels entering the Gulf of Mexico which navigate close to the Florida reefs to avoid the strong currents of the gulf stream. Referring to the proposed island fortifications for the entrances to the Chesapeake, it is suggested that it would be a great economy if one of our old battleships, such as the "Oregon" were used as a central point about which the island could be built.

Congressman Hobson goes further than this. In his opinion it would be well to build torpedo tubes right in the islands, thus making them more effective. At Hampton Roads, the mouth of the Mississippi, the entrance to Puget sound, the Golden Gate, San Diego, and Mobile, these ships would make fine practical forts, he says.

RATS IN THE CAPITOL

Several tons of seed, sent over from the Department of Agriculture, to be distributed to the constituents of congressmen, was the attraction which drew thousands of rats and mice of various sizes to the basement of the house of representatives at Washington recently, and caused the officials in charge of the capitol great worry and apprehension. The nuisance was abated only when the supply of seeds began to run low.

View of the New Pennsylvania Terminal from a Nearby Roof, Showing the Immensity of the Structure



Concourse and Track Level of Pennsylvania Terminal

PENNSYLVANIA RAILROAD STATION IN NEW YORK

The new Pennsylvania terminal in New York is undoubtedly the finest structure of its kind in the world. It covers two city blocks and one intersecting street, covering an area of about eight acres. It is 774 ft. long, 433 ft. wide, and has an average height above the street level of 69 ft., and a maximum height of 153 ft. The main waiting-room is 277 ft. long, 103 ft. wide, and 150 ft. high, while the concourse is 340 ft. long and 210 ft. wide.

The huge building is of steel skeleton construction, with masonry curtain walls, supported by a system of columns extending to rock foundation. The level of the track system below the street surface varies from 39 to 58 ft., and is from 7 to 10 ft. below mean high water in the harbor, thus necessitating the establishment of an elaborate system of drainage over the entire station area. Access to the street is gained by elevators and stairways.

The design of the interior of the general waiting-room was suggested by the halls and basilicas of Rome, which are the finest examples in the world, ancient or modern, of large roofed-in areas.

CHINESE BOMBARD COMET WITH FIREWORKS FROM HILLTOPS

When the excitement due to the return of Halley's comet was at its height in May, a great wave of fear swept over the Chinese empire. In January when the comet was first seen, the Chinese began to send up fireworks, and when the comet made its nearest approach, they were so convinced that it was headed for the earth, and if not swerved from its path, would destroy it, that they began discharging fireworks more abundantly than ever, taking deliberate aim at the visitor. Great columns of inflammables were also erected on almost every mountain top in an effort to show the comet that it was not wanted.

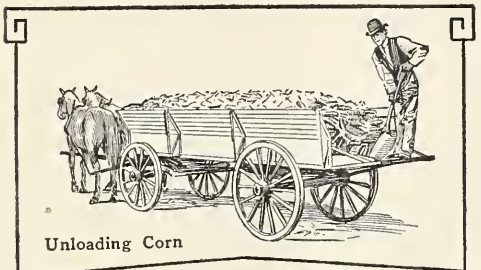
A WAGON BED OF MANY USES

A convertible wagon bed which can be changed into 15 different kinds of bodies for different uses around a farm, without adding to it or taking from it a single piece, has been designed, and is undoubtedly the most radical improvement made in farm wagons for a decade.

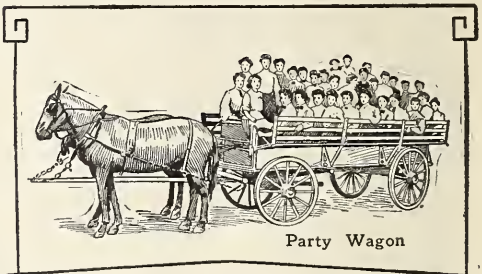
In a few minutes it can be transformed from a hay rack into a wagon for carrying livestock, and with equal quickness it can be converted into a vehicle for carrying a large number of passengers who can be provided with comfortable seats along the sides for picnicking, etc.

The remarkable versatility of the new wagon bed is secured by hinged malleable iron pieces attached to the sides. These support two folding sections on each side. The strain which is put upon these pieces when heavy loads are placed on the wagon makes it imperative that they should be of strong, dependable material.

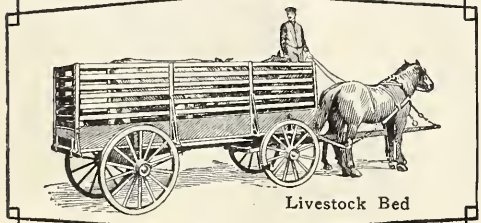
The agriculturist has often found it a hardship to be obliged to buy or build a number of wagons for the multifarious requirements incident to the operation of a farm. The wagon that would serve to carry boxed or crated vegetables and berries to market



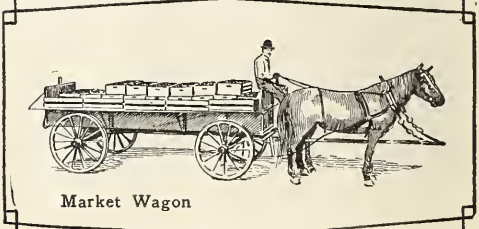
Unloading Corn



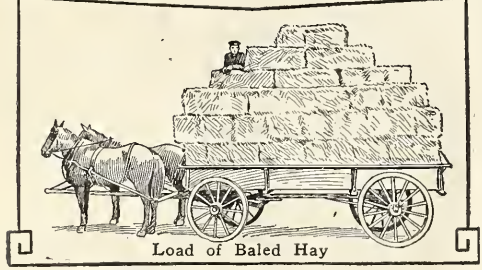
Party Wagon



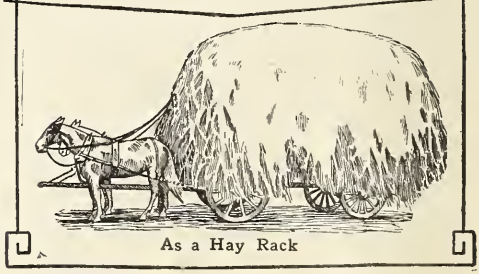
Livestock Bed



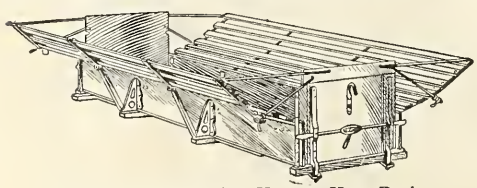
Market Wagon



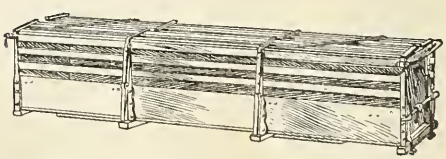
Load of Baled Hay



As a Hay Rack



Wings Extended for Use as Hay Rack



Wings Folded Over for Hogs, Sheep, Etc.

would not be of any use when haying time came around. When it was necessary to carry calves or livestock, still another wagon must be called into service.

While reapers, threshers, and other farm implements have been continually improved, the farm wagon has remained practically at a standstill. Perhaps the fact that the automobile has made such wonderful progress has served to overshadow the humble beast of burden and his reliable wagon. Old Dobbin may be a second rater now, but he will continue for some time to fill his particular sphere of endeavor with a faithfulness which the motor car cannot always be relied upon to give.

THE DALAI LAMA AND HIS PEOPLE

Lassa, the ecclesiastic city of Tibet, and for many years the most mysterious city in the world because prohibited to the white man, was advanced upon several months ago by several thousand Chinese troops, whose mission was to depose the Dalai Lama. At one time the authorities of Tibet refused to allow Europeans to even enter the country.

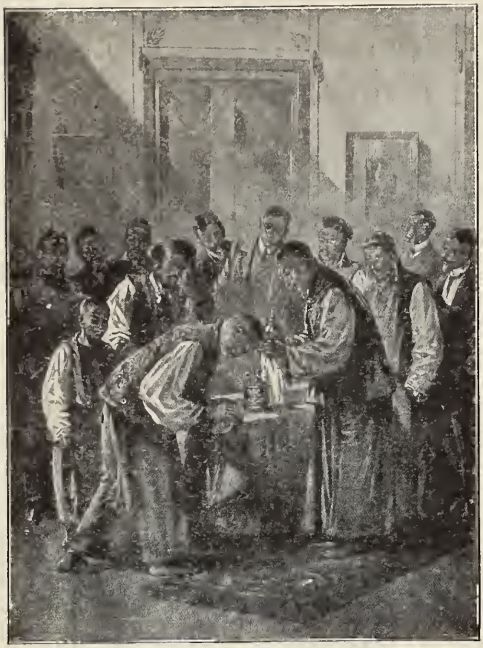
Tibet is a dependency of the Chinese Empire, lying between China and India. It covers an area of about 600,000 square miles, and has a population of over 6,000,000. China, however, up to the present time, had only interfered with foreign and military affairs, the civil and religious government being left to the Tibetan clergy. In theory, supreme rule was in the hands of the Dalai Lama, the sovereign pontiff.

The Dalai Lama and Attendants

Typical Tibetan Type

When China decided to depose the present Dalai Lama he refused to yield and the troops were sent against him. He escaped and became a fugitive in India. The figure in the center of one of the illustrations is the deposed ruler, whose full name, by the way, is "A-Wang-Lo-Pu-Tsang -Tu - Pu -Tan - Chia-Cho-Chi-Chai-Wang-Chu - Chio-Le-Lang-Chieh." The wretched condition of the people over whom he held almost undisputed rule is evinced by the raggedness of the curious clothing they wear.

When the Dalai Lama was a fugitive in India a very interesting occurrence took place. The ashes of Buddha and many relics, discovered about the time the Dalai Lama fled from Lassa, were discovered in India. The remains of Buddha were taken to the Indian museum house at Calcutta, to be formally



The Dalai Lama Holding the Ashes of Buddha

handed over to those representatives of the Buddhist religion who had journeyed from Burma for the purpose. There the fugitive Dalai Lama, who is said to be the reincarnation of Buddha, was allowed to view the ashes of his first embodiment.

One of the illustrations shows the Dalai Lama holding the gold casket containing the ashes, and touching the crowns of the heads of his followers with it, as they passed before him.

Tibetan Family and Home

JAPANESE TO HONOR COMMANDER OF LOST SUBMARINE

The public in Japan is preparing to erect a monument to the memory of Lieutenant Sakuma, the commander of the submarine which was lost on April 6th during maneuvers, the entire crew of 14 men perishing. The submarine, which was known as "No. 6," was one of a flotilla of seven taking part in the meneuvers. They had been under water for four hours, and all came up at the end of that time with the exception of "No. 6." Search was then made, and the little craft was found at a depth of 52 ft.

The loss of the boat was caused by a broken chain in the ventilation tower, which opened the sluice valve and allowed the water to pour into the boat. Desperate efforts were made to close the valve, but without avail. The electric regulators and lights were put out, and the machinery which supplied the crew with air came to a stop.

The commander of the submarine, when he saw that the end was inevitable, sat down and calmly prepared a record of the accident, begging the forgiveness of the emperor, and taking upon himself the blame for the accident. The record closed as follows: "The air pressure becomes high, and I feel as if my ear drums were bursting. I feel great pain in breathing. I thought I had blown out the gasoline, but I have been intoxicated by it—."

¶ Furniture casters are now being made with a bearing surface of compressed felt, which will not mar a polished floor.

EDITORIAL

THE average yearly number of patents issued during the past four years is about 35,000. An examination of the records of the Patent Office shows that in a large percentage of the patents issued or granted the entire or a part interest was disposed of by the patentee for considerations running from a nominal sum of one dollar to $100,000.

Other branches of the Government are engaged in the conservation of natural resources, such as forests, the streams, the harbors, and the mines, and all of this work is carried on at enormous expense, with no expectation of direct returns, but in the belief that it is a wise policy to develop the material resources of a nation. Many of the critics who would destroy the patent system of the United States are entirely satisfied with the Government's policy in developing natural resources, but do not agree that it is good policy to develop the greatest asset of a nation, to-wit, the brains of its human members.

The only justification for any criticism of our patent system is found in the abuse of the powers and privileges it gives to the owners of a patent. It has been said that our laws should require a patentee to manufacture and offer for sale the invention covered by his patent, so that the public can get the benefit of it, this being the law in most of the foreign countries having patent systems. While our law does not say this, and while it does permit the owner of a patent to produce the article or not as he sees fit, if he fails to manufacture his machine or device, he cannot recover damages should some one make and market his invention. All that he can do is to enjoin the infringer from continuing such infringement.

The provisions of foreign patent laws which forfeit a patent unless the invention is manufactured and offered for sale within a certain specified time work hardship in many cases where the inventor is financially unable to make or market his device or machine, and is unsuccessful in securing the necessary financial backing to do so. Such laws cater to the power of wealth and make it possible for those controlling certain lines of manufacture to withhold their approval of a patented invention so that the inventor cannot successfully market or finance his undertaking; and then when his patent has expired because of his failure to manufacture and sell, these interested parties will come in and take advantage of this condition and thereby get the benefit of the improvement without compensating the inventor.

It is true that under our law patents lend themselves to the creation and maintenance of monopolies, but under the most favorable circumstances these monopolies are short lived, rarely extending beyond the seventeen years' term of the original patent. In many industries large sums of money must be spent in perfecting and commercially exploiting the invention, and the risk attending this is sometimes very great, as the investor never knows when what is believed to be a perfect development may be superseded by something entirely different and very much more desirable.

The art of street car propulsion illustrates in a most significant manner the evolution of industry and invention which renders obsolete in a few years what has required the expenditure of millions of dollars to develop. Endless cables for propelling street cars were in vogue but a few years ago, and on the strength of the apparent value of the cable system millions of dollars were invested in plants and machinery for producing the cables, pulleys, driving drums, conduit yokes grips, etc., required in such a system. Within a period of ten years all of this special machinery and thousands of tons of castings became obsolete and fit only for the scrap heap.

* * *

A YEAR ago quite a furore was made over the proposed plan, which if not to prolong our lives was literally to lengthen our days by setting the clock hands an hour ahead in early summer and back again to first principles when the sun resumed getting up late mornings. The daylight-saving bill was seriously considered in Parliament, but failed to become law, although Birmingham, England, and Cincinnati, Ohio, actually passed ordinances. Both cities after a futile attempt to enforce the undesirable measure repealed it. The idea, which like most fads was not without its good features, was given the widest possible publicity in the press, but public opinion was against it. The interesting thing is how soon the pendulum swings to the other extreme, for in the space of twelve months a most talked of incident has become the most forgotten.

THE introduction of the big "Pay as you Enter" street cars has been accompanied by the elevation of the car step to a height which makes it impossible for a child to enter unassisted. This has furnished material for sundry newspaper cartoons in which the small boy is made to say, "Lift me up, Somebody." This small boy, however, is depicted as well dressed, and accompanied by a well dressed mother.

There are some thousands of other small boys, one or more in every community, just as bright, and promising and ambitious, whose "Lift me up, Somebody," deserves attention. They are not the juvenile derelicts; they do not belong in reformatories. They are simply unfortunate in being born into conditions and environments which make difficult or impossible any great progress. Of recent years several manual training schools have been established which provide both a home and an education—education of the practical kind, where the hand and brain develop together, and where high ideals of a real life are taught. Most of these boys are orphans, who have been left penniless; boys who come of good parentage. There are no frills about these training schools; the boys work in shop and field, and develop into robust, manly men, fit to take their place in the world. These schools are supported by voluntary contributions.

Higher universities, schools of advanced learning, and specialties in education where a high-priced professor lectures to a mere handful, are good and essential. It is proper such should be generously endowed; but there are many men who came up to success and wealth out of their own efforts, to whom college endowments do not strongly appeal. The good which such can do, with comparatively little money, in supporting or founding one of the Training Schools for Boys, is so far reaching, and the net results so large, that it would seem necessary only to acquaint them with the possibilities to enlist their interest and support.

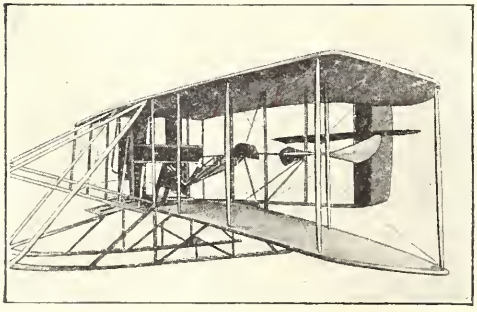
These schools can be started in a comparatively small way, with a few thousands of dollars, but the good they accomplish will continue on years after the donors have ceased making money. Succeeding generations of bright boys will cherish their memories in grateful remembrance.

The power of money to do evil may be great, but nothing like its power to do good.

H. H. WINDSOR

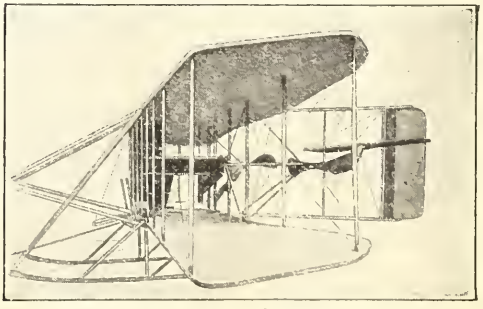
WARPING THE SURFACES OF AN AEROPLANE

Much has been written about the warping of the surfaces of aeroplanes in making turns, but very few of the photographs or drawings of the process have shown it satisfactorily. The accompanying illustrations, however, show the warping process very clearly. The lower wing tip in the foreground of the first is warped to increase the lifting effort, the far tip being simultaneously warped in the opposite direction. In the second illustration the near lower wing tip is warped downward to diminish the lifting effort, the far tip being warped upward.



Wing Tip Warped to Increase Lifting Effort

The illustrations were made of the United States army aeroplane bought from the Wrights. Each of the main planes or curved surfaces has three parts, a main central section and two winged tips. The central section is 13 ft. long and each tip 11½ ft. long. If the controlling wire is pulled towards the left, the right tip will be pulled down and the left up, and vice versa.



Wing Tip Warped to Diminish Lifting Effort

HOW TO BUILD THE FAMOUS "DEMOISELLE"
SANTOS-DUMONT'S MONOPLANE

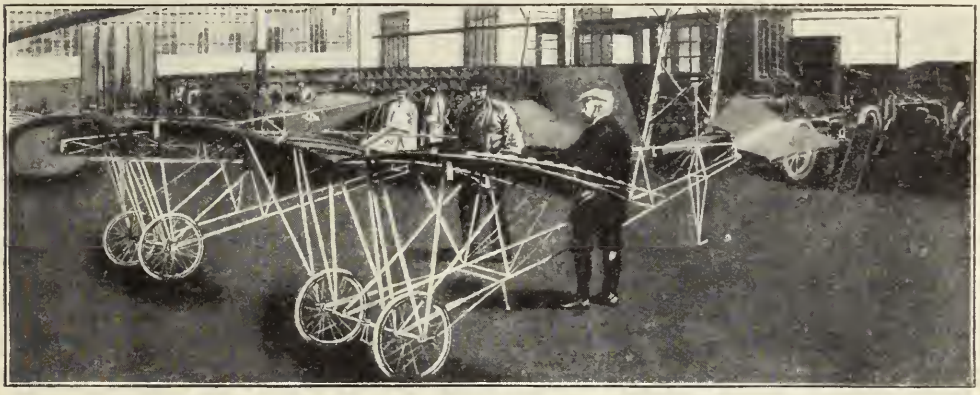
By ARTHUR E. JOERIN and A. CROSS, A. M.
(*Paris*)

(*Continued from the June number of Popular Mechanics*)

Having finished the steering arrangement it would be wise to take up the construction of the wings. The wings of the "Demoiselle" are made entirely of bamboo rods with bamboo or ash lateral beams as shown in Plate V. However, Clement Bayard, at whose factory in France these monoplanes are being manufactured, makes them of poplar or ash. Aluminum tubes have also been used. It would be advisable, however, to stick to the bamboo rods which served Santos-Dumont so well.

front. The whole plane structure is kept rigid by guide wires running from the rods to the frame as shown in Plate I.

In order to attach the cloth to the extremities of the rods, it is not necessary to employ any other method than that shown at C, Plate III. This is the best method known. As with the steering device the front ends of the rods have to be covered by means of cloth hemmed over. This diminishes the friction of the air against the rods. Santos-Dumont has not always used the same



Building Santos-Dumont Monoplanes at the Clement Bayard Factory in France

In order to secure the curves as shown at the top of Plate V, on the left, it would be sufficient to bend the rods over a form by force. They may also be bent by means of a string tied to the ends, drawing them together, and then plunging them into boiling water for about 15 minutes. The rods should be given plenty of time to dry before the strings are removed and they are placed in position. They will retain their shape if given time to dry, so no attempt should be made to hasten matters. If the builder desires to use wood he may proceed in like manner. The curve is almost the true arc of a circle.

It is not necessary to bend the rear lateral rod. It suffices to bend the one in

method of attaching the cloth, but the method shown here is the one he used on the machine with which he made the famous flight, and is the method which the builder is advised to follow.

In the original flyer there was a rod just above the head of the pilot. It has been thought advisable, however, to leave this rod out. Santos-Dumont is quite short, and when he was in the pilot's seat, his head did not reach the rod. In the machines now being manufactured in France, the rod is omitted.

The wings completed, it would be well to next undertake the construction of the frame. The wheels are easily made, for, save that they have a longer hub, they are very similar in construction to the

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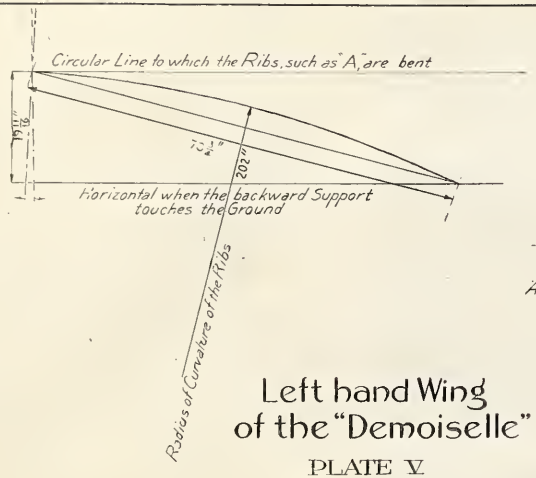
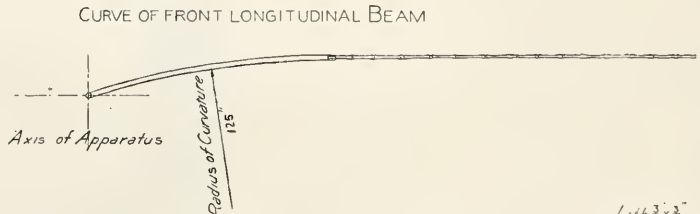
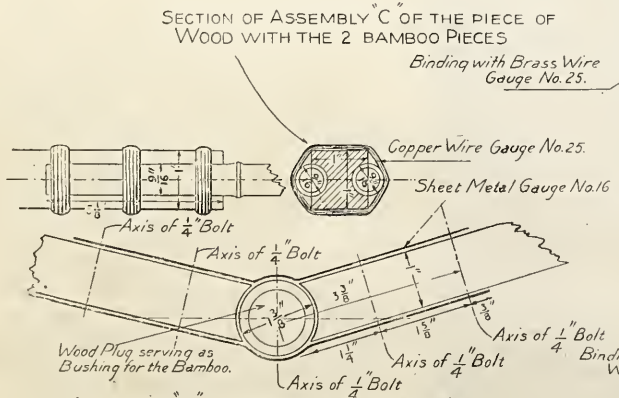
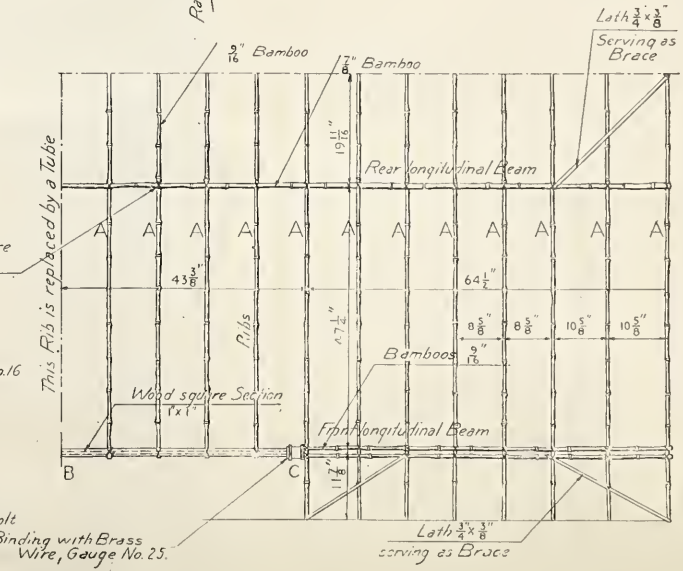

Circular Line to which the Ribs, such as "A," are bent
19 11/16"
75 1/4"
202"
Horizontal when the backward Support touches the Ground
Radius of Curvature of the Ribs



Left hand Wing of the "Demoiselle"

PLATE V.


SECTION OF ASSEMBLY "C" OF THE PIECE OF WOOD WITH THE 2 BAMBOO PIECES
Binding with Brass Wire Gauge No. 25.
Copper Wire Gauge No. 25.
Sheet Metal Gauge No. 16
Axis of 1/4" Bolt
Axis of 1/4" Bolt
Axis of 1/4" Bolt
Axis of 1/4" Bolt
Axis of 1/4" Bolt
Wood Plug serving as Bushing for the Bamboo.
ASSEMBLY "B" OF THE FRONT LONGITUDINAL BEAM WITH UPPER BAMBOO OF FRAME

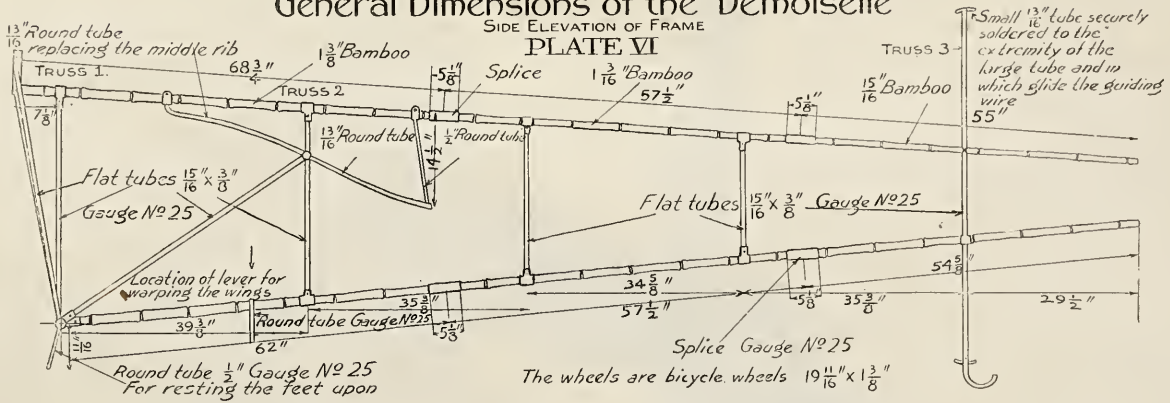


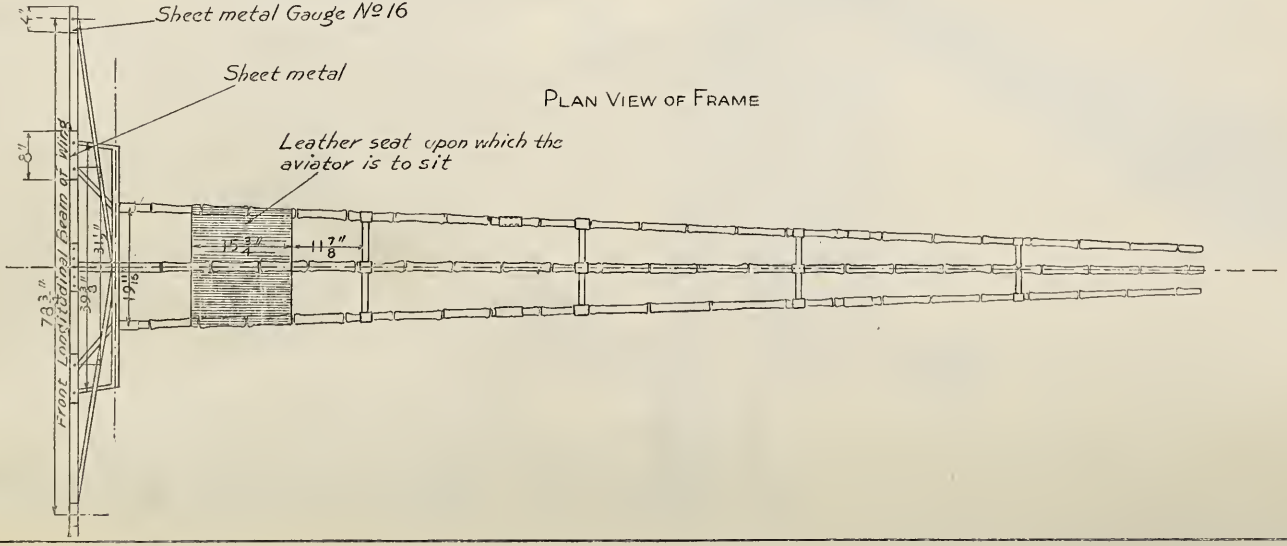
View of the "Demoiselle" Showing Position of Motor and Propeller

General Dimensions of the "Demoiselle"

Side Elevation of Frame

PLATE VI


13/16" Round tube replacing the middle rib
1 3/8" Bamboo
Truss 1
Truss 2
Truss 3
Splice
1 3/16" Bamboo
15/16" Bamboo
Small 13/16" tube securely soldered to the extremity of the large tube and in which slide the guiding wire
55"
13/16" Round tube
1/2" Round tube
Flat tubes 15/16" x 3/8" Gauge No 25
Flat tubes 15/16" x 3/8" Gauge No 25
Location of lever for warping the wings
Round tube Gauge No 25
62"
Round tube 1/2" Gauge No 25 For resting the feet upon
Splice Gauge No 25
The wheels are bicycle wheels 19 11/16" x 1 3/8"



Plan View of Frame

ordinary bicycle wheel. In the construction of these wheels it would be well to use strong wire spokes, for at times, when the machine strikes the ground suddenly, great stress is put upon them. Santos-Dumont experimented a long time with the wheels before he finally settled on a hub length of 6 in. This he found was strong enough to support the machine when he used a 35-hp. motor. If a lighter motor is used, the size of the wheel hubs may be modified. These hubs are, as may be seen in the drawings, simply put on over the tubes and fastened by a cotter pin. The tubes should be allowed to extend out several inches beyond the end of the hub. Great care should be taken in the selection of this lower tube, for almost the entire weight of the machine comes upon it. It is not necessary to provide any special bearings for the wheels, as it is intended they should work with a slight friction. It may readily be seen that the wheels are inclined toward one another at the top. The angle of inclination of that part of the tubing, which forms the axle, is 1 to 9. This manner of placing the wheels prevents them from being broken when subjected to a slight jar if the machine takes to the ground unexpectedly.

The connection of the tubing with the framework of bamboo is somewhat difficult, but the details of assembling are always the same in principle, and are shown on Plate VII. The pieces, which are to hold the tubes, are prepared beforehand, and when the tubes are introduced, the whole is firmly bolted. (See Detail of Assembly "A" on Plate VII.) If the builder does not care to prepare these special pieces, the flattened end of the tube may be affixed to a square piece of metal by means of an additional bolt. It is considered better, however, to prepare these special pieces as receptacles for the ends of the tubes.

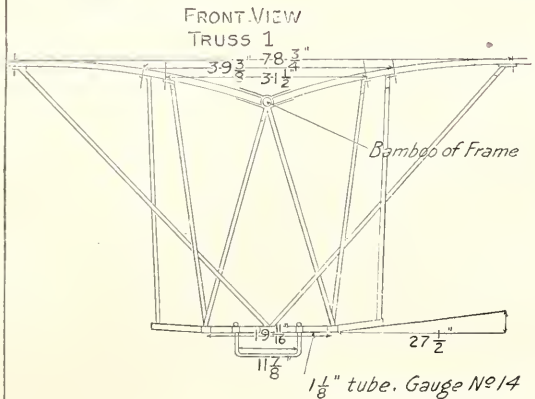
It would be imprudent and dangerous to make a hole in any of the three main bamboo rods which constitute the frame of the machine, for this would detract from their strength. When we are ready to attach the tubing to the frame, it would be well to follow the method shown on Plate VII. (Detail of Assembly of a Post with the Bamboo.) Out of a piece of sheet metal a joint may be formed so as to make a receptacle for the end of the tube. Provision should be made by a small piece of metal so that the bamboo will be protected if the end of the tube should strike it. Pieces of sheet metal can be wound around the bamboo rod as indicated on the drawing.

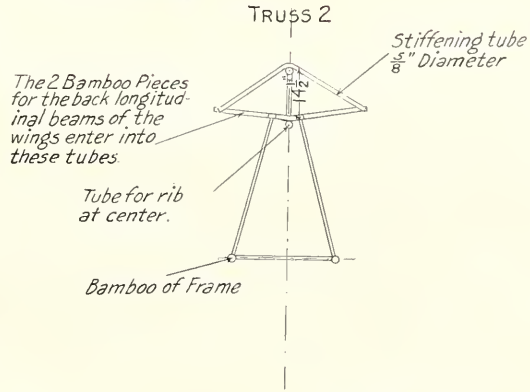
Let us now call your attention to the joint at the junction of the lower bamboo rods with the two upright tubes at the inside bearing of each wheel. This fork-like joint should be brazed in the manner of a bicycle frame. It may also be forged or made of a piece of sheet metal forced into shape. There may be some play at the joint, but this does not matter, as the wire stretchers, to be put on afterward, will give the necessary strength, and prevent the pieces from gliding one upon the other.

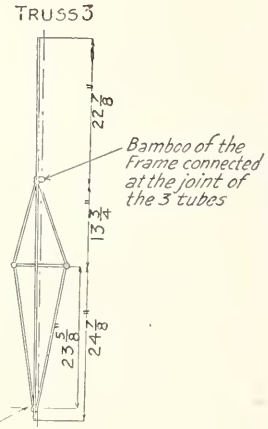
The machine thus far completed, we may proceed to attach the piano wire stretchers, and then the wires controlling the horizontal and vertical rudders and governing the warping of the planes. The rudder controls may be installed in accordance with the builder's ideas, and the motor controls will vary, of course, with the type of motor used. In the "Demoiselle" the wire regulating the horizontal rudder is attached to a lever within easy reach of the pilot's right hand. The vertical rudder is governed by a wheel at the pilot's left hand. The lever which controls the warping of the planes is placed behind the pilot's seat. Santos-Dumont operated this by bending his body to the right or left, the lever fitting into a tube fastened to his coat in the rear. A side movement pulls the rear end of the wing opposite to the side to which the pilot leans. The balancing of the whole apparatus, is, therefore, in a manner, automatic. The pilot has but to bend over to one side in order to balance the machine. Springs are introduced on the wires which control the rudders of some of the machines so as to bring the rudder back to its normal position without effort on the part of the operator. The seat is a piece of canvas or leather stretched across the two lower bamboo rods just behind the wheels.

Details of the "Demoiselle"

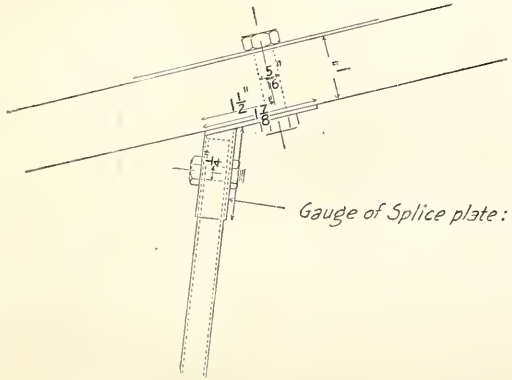
PLATE VII



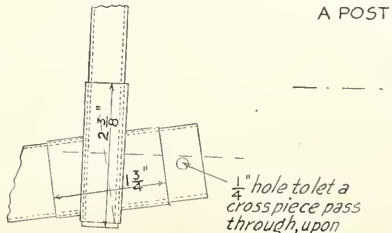

TRUSS 2
Stiffening tube 5/8" Diameter
The 2 Bamboo Pieces for the back longitudinal beams of the wings enter into these tubes
Tube for rib at center.
Bamboo of Frame


TRUSS 3
22 7/8"
Bamboo of the Frame connected at the joint of the 3 tubes
13 3/4"
23 5/8"
24 7/8"
The lateral tubes are flattened and are joined by a bolt at the middle cane

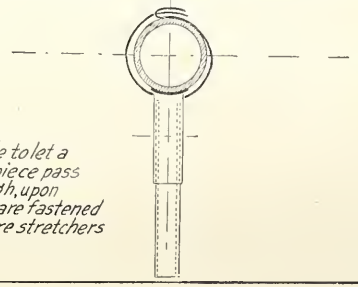
DETAIL OF ASSEMBLY "A"

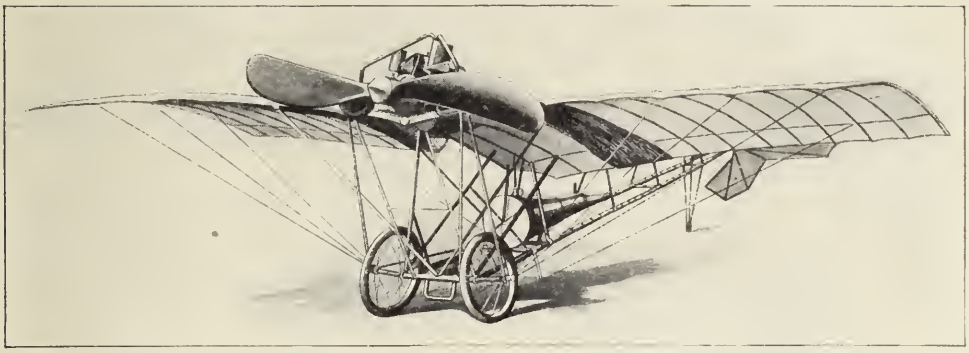


DETAIL OF ASSEMBLY "B"



DETAIL OF THE ASSEMBLY OF A POST WITH THE BAMBOO.





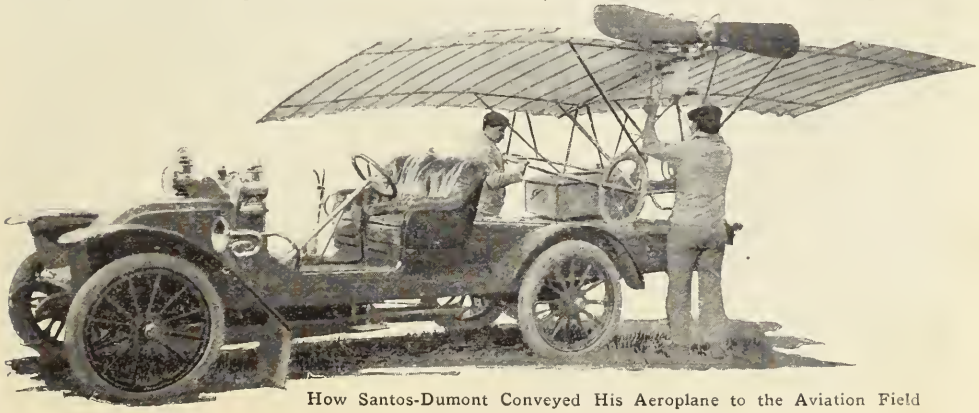
This View Gives a Good Idea of the Location of the Gasoline Tank and the Radiator

Santos-Dumont had his motor control so arranged that he could regulate the supply of gasoline by his foot. The spark switch may be placed on the steering lever. These controls may be arranged differently, however, with other motors.

It is of prime importance that the motor should be perfectly balanced. It should be direct connected to the axle holding the propeller. The gasoline reservoir is located behind the pilot's seat, the fuel being forced up into a smaller one just above the motor. In his remarkable flight from St. Cyr to Buc, the inventor of the monoplane used a two-cylinder Darracq motor of 30 hp., which gave the propeller 1000 r.p.m. It weighed a little over 99 lb. The entire machine weighed 260 lb. without the pilot. At the end of the crankshaft, opposite the propeller, is a pinion and eccentric working the oil pumps. This pinion also meshes with the gear which operates the water pumps. The cams which raise the valves at the same time operate the magneto. The radiator, which is composed of a great many small copper tubes connected up to a larger tube at the front and rear, is placed under the main surface of the wings and extends from the front to the rear of the planes.

RAZORLESS SHAVING OUTFIT

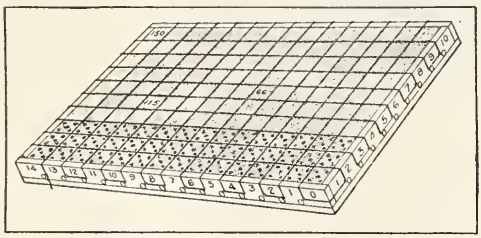
A razorless shaving outfit, consisting of a sponge, two measures, a shaving cup, and a powder the mere application of which (mixed with water) removes the hair as faultlessly as the best razor, has just been introduced as the latest tonsorial discovery. The fact that it is warranted to contain no acids, give out no offensive odor, and accomplish shaving without danger of cutting, might persuade some shavers to contemplate substituting it for the time-worn razor. The powder is, however, only for post mortem shaving.



How Santos-Dumont Conveyed His Aeroplane to the Aviation Field

TEACHING THE COUNTRY BOY AND GIRL TO TEST SEED CORN

The importance of testing seed corn before planting, and testing it in the ear rather than after shelling, is now understood by every farmer. To continue to keep the lesson alive and teach



Sand Tray for Testing Seed Corn

the farm boy and girl how to test the corn the department of agriculture gives the following information:

There are at least three reasons why teachers, especially in the rural districts, should be interested in seed-corn testing as a school exercise. It furnishes an interesting study in seed germination and plant growth, extends a method of vast economic value in improving the productiveness of American agriculture, and its teaching in rural schools exerts a strong influence towards increasing the confidence of parents in the permanent worth of good school work.

Many farmers, although knowing the value of seed testing, fail to carry it out because many of the methods recommended mean too much trouble. The plan here described is simple enough to be easily followed by any boy or girl in the public schools, and costs very little.

The only materials needed are a shallow wooden tray, a small handful of carpet tacks, a few yards of wrapping twine, sand enough to fill the tray, and three or four quarts of water. The tray can easily be sawed from an empty soap or cracker box. When finished, it should be about 1½ in. deep inside, 15 in. wide, and 23 in. long. The tray is then divided into small squares by a checker-board lacing of twine across the top. It is convenient to have these squares about 1½ in. square, 10 of them in a row across the narrow way of the tray, and 15 the other way.

The illustration shows the general appearance of the tray and the method of lacing the twine back and forth across the tray and under the tacks. This lacing with the string should not be done until the tray has been loosely filled with dry sand, heaped up a little above the top edge. Then the sand should be scraped off with a yardstick. After lacing with the twine the tray is ready for planting.

Have the children arrange the ears to be tested in rows of ten, to correspond with the rows of squares across the tray. These rows of ears should be kept in a dry, warm place on the floor, on corn racks, or on shelves, where it can be certain it will not be disturbed or displaced until the test is finished. When ready to begin the test, two children can work to the best advantage, one to handle the individual ears and the other to plant the tray. The first takes up ear No. 1 in the first row, and, with the point of a pocket knife applied to the edge of a kernel, removes five kernels from each ear, passes them to the second pupil, and carefully replaces the ear in its row. The kernels should be taken in succession (taking only those of average size) from about an inch above the base of the ear to the same distance below its tip, passing spirally around and lengthwise of the ear. This insures a fair test of the whole ear, as it sometimes happens that one side or one end of an ear is sound while the other will not grow. The second pupil plants each five kernels in the square which corresponds with the ear from which they were taken. Four are placed in the corners, and the fifth, in the center. The illustration shows the first three squares planted in each of the 15 rows.

When a tray has been planted it must be thoroughly watered and kept in a warm room. The watering is best

done by laying a small piece of paper flat on the tray and pouring the water carefully upon it until the sand is fully saturated. The planted tray should not be allowed to dry out until the young corn plants are an inch or two above the sand.

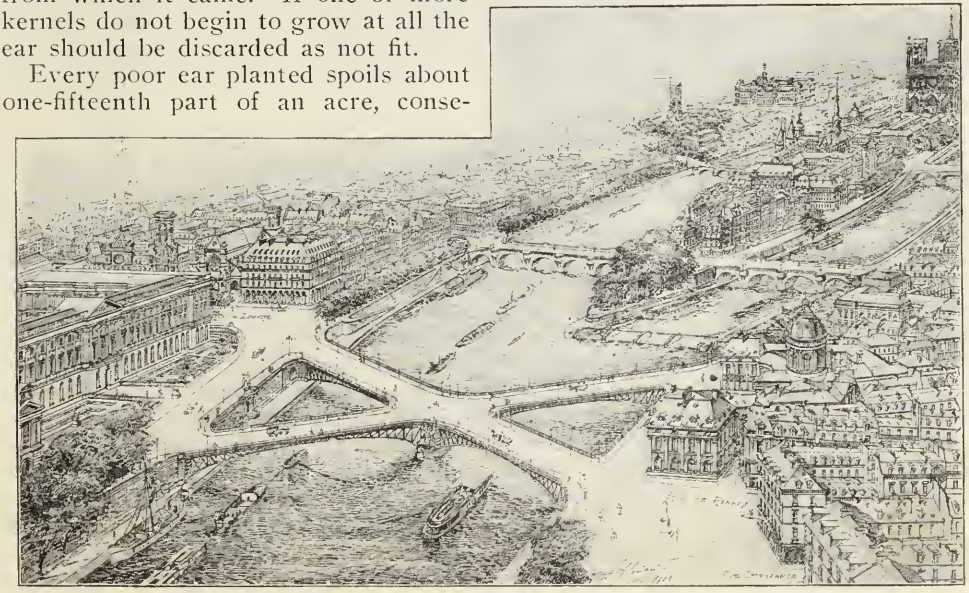
The plants should be about two or three inches high before the test is made. Begin at square No. 1 and carefully examine each square in regular order through to the last. If you find five good, sturdy plants growing from the five kernels planted in a square, the ear from which they came is all right for shelling and planting in the field. If there are five plants in the square, but two or more are shorter than most of the others in the tray, or look pale and sickly, take at once the ear from which they came out of its row and discard it. If there are four good plants in the square, but the fifth one is smaller or cannot be seen at all, dig down carefully until you find whether the kernel germinated. Sometimes the young stalk is held at the tip by the tough skin or hull of the kernel until it is bent over and starts to grow horizontally or downward. This would not show any positive fault in the ear from which it came. If one or more kernels do not begin to grow at all the ear should be discarded as not fit.

Every poor ear planted spoils about one-fifteenth part of an acre, consequently the testing of seed corn in this manner is of the greatest value to the farmer.

LETTER-"X" BRIDGE PROJECTED FOR PARIS

Paris, which is today considered one of the most beautiful cities in the world, is still striving to become more beautiful, and to make this possible the city has been authorized to borrow the immense sum of nearly $200,000,000. Half of this will be used for the upkeep of municipal edifices and the erection of new buildings, and for parks and promenades. The other half will be used for the creation of new boulevards and highways, and the maintenance of the old.

One of the interesting units in the scheme for improvement is the projected letter-"X" bridge shown in the illustration. If erected, it will cross the Seine, one branch connecting the rue de Rennes with the rue de Louvre, and the other forming a junction between the wharf of the Louvre and the wharf Conti. A single pier rising from the Seine will hold the center of the bridge up.



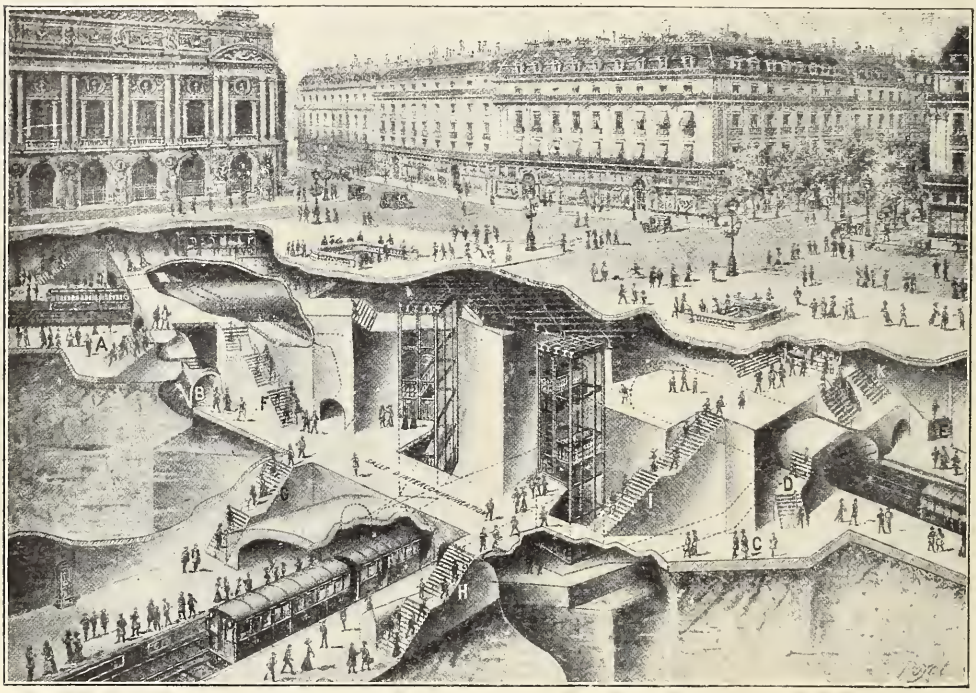
Unique Bridge Planned for Paris

THE BUSIEST UNDERGROUND CORNER IN PARIS

Of all the wonderful engineering work done by the Metropolitan underground railways of Paris the most complicated is that under the Place de l'Opera, where three great tubes cross each other, all of which must have station facilities in the crossing's tangle. The three tubes, the platform, stairways, and elevators constitute a veritable Chinese puzzle, and the wonder is that the congested underground and overhead traffic has not been even more disturbed during the work.

The labyrinth of approaches and platforms, there being six of the latter, make possible a quick exchange from one line to another, or passage to and from the surface. In order to make it easy for the public to find the direction to take, there is a vast room for intercommunication giving access to all platforms. The people taking trains will be dropped to the desired train levels by the elevators running from the ticket-rooms.

The illustration clearly shows the three subway tubes, the platforms, stairways, elevators, and two of the openings leading from the boulevard.



The Intersection of Three Underground Railways

HEAR HEART BEATS 100 MILES

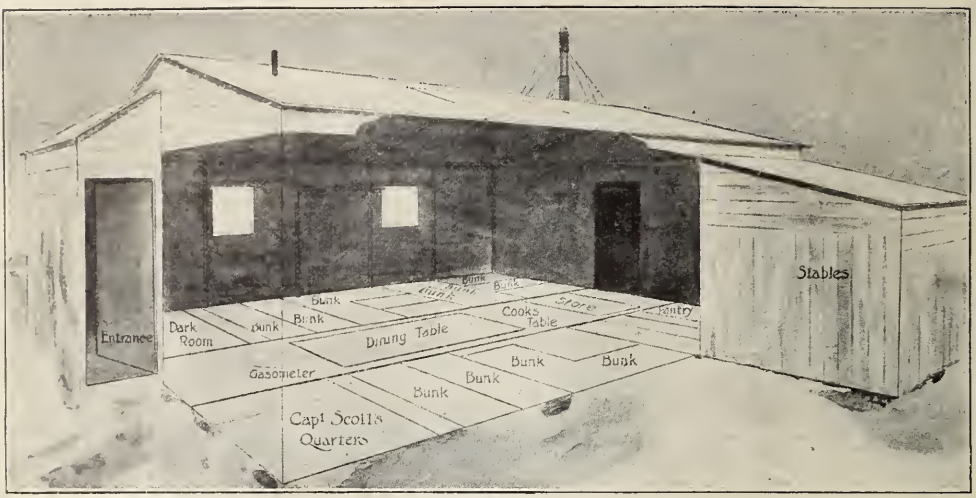
By means of a special apparatus at one end of an ordinary telephone line a group of experimenting physicians were able to note the heart beats of a patient 100 miles away. The test was made to determine the possibility of diagnosing heart trouble at a distance.

The physicians were at the house of Mr. Milne, the noted seismologist, on the Isle of Wight, and the person whose heart was tested was in London. A stethoscope, held over the heart in the ordinary manner, was attached to a special telephone instrument by which sounds are magnified.

CAPTAIN SCOTT'S POLAR EQUIPMENT

Mention of the motor-sleigh Captain Scott will depend upon to a great extent in his dash to the South Pole has already been made, but these illustrations deal with the ship on which the expedition will penetrate the ice floes, and the hut in which the explorers will live after landing.

Appearance of the Bow of Captain Scott's Antarctic Vessel, the "Terra Nova"

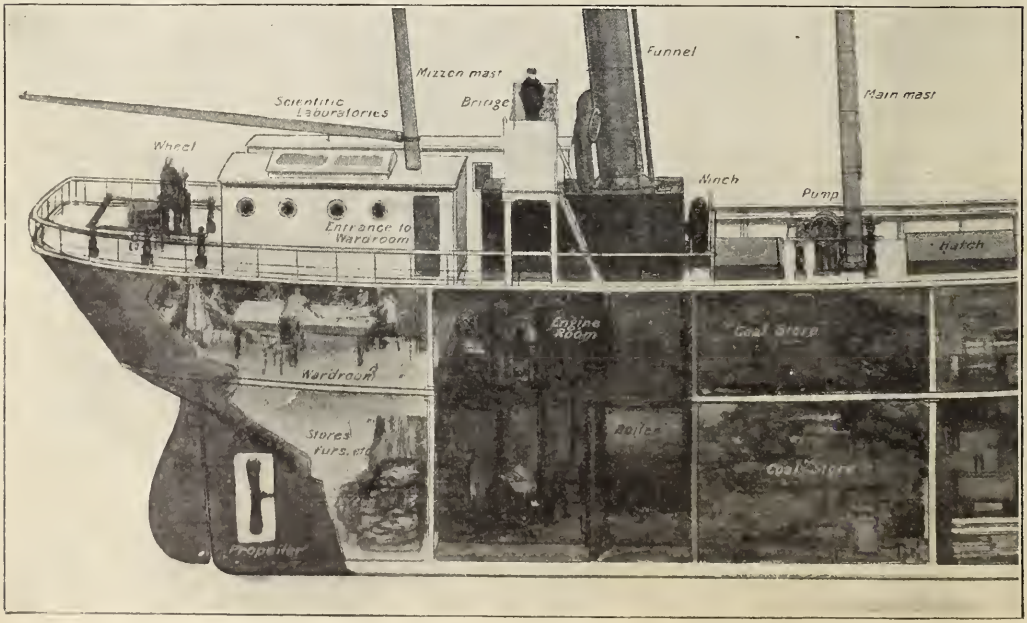


Courtesy of the Sphere, London

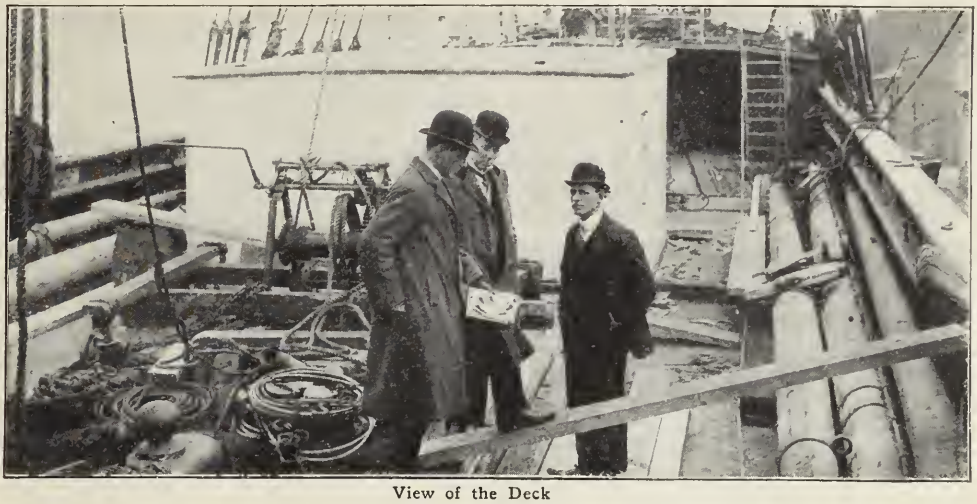
Plan of the Hut

The sectional view of the "Terra Nova," which is the name the staunch vessel bears, shows the disposition of stores, engine room, laboratories, officers' and men's quarters, and the deck plan. The other illustrations show a deck view taken while the outfitting was being carried on, and a bow view. Two of the three men superintending the outfitting are Captain Evans and Lieutenant Campbell. The heavy ice armor is clearly shown in the bow view, as well as the masts and booms that will carry auxiliary sail.

The hut is of the knockdown variety, and is quite commodious, as the illustration shows. The dark-room for photographic work, Captain Scott's



Sectional View of the "Terra Nova"



View of the Deck

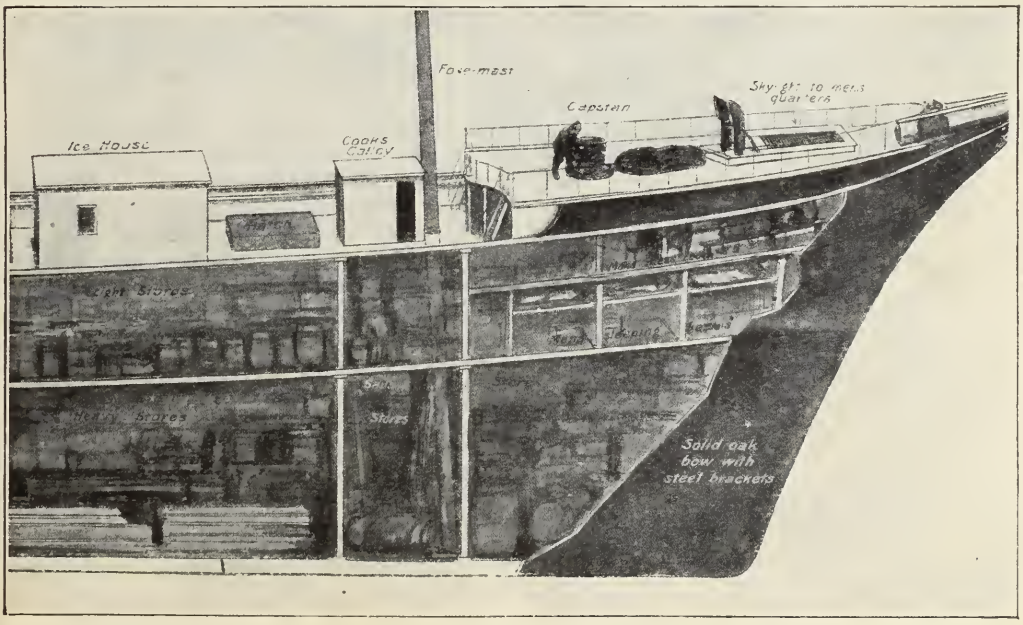
quarters, and the arrangement of bunks, dining-table, etc., are marked off in the floor plan.

The "Terra Nova" was built in 1884, and she was, and still is, the largest whaler in existence. She is 187 ft. in length with a beam of 31 ft. The displacement is 749 tons.

The vessel is bark-rigged and is equipped with a 140-hp. steam engine. This will enable her to make nine knots an hour without sail.

The "Discovery," which carried Capt. Scott's previous expedition was smaller and somewhat cramped as to accommodations.

A special expedition left England recently for Vladivostok, thence into northeast Siberia, for the purpose of securing dogs.

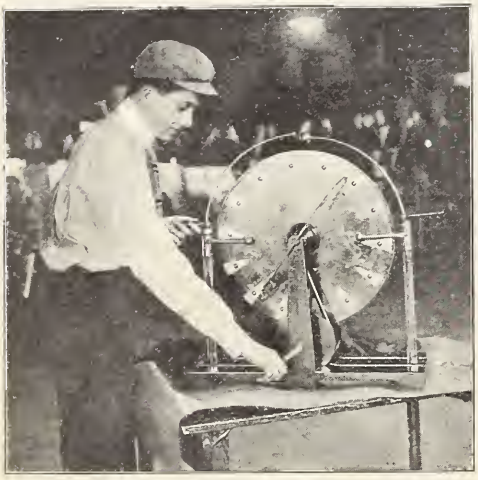


Captain Scott's Antarctic Ship

CLEVELAND BOYS SHOW WORK OF HANDS AND MIND

By E. C. HOPWOOD

A UNIQUE exhibition, one which may be generally copied throughout the country, was recently held at Cleveland, O. The exhibition was



A Static Machine and Its Maker

planned to show what the boys in a city of half a million people could do in mechanics, the arts and crafts, music and literature, and the training of animals.

The mechanical and arts and crafts part of the exhibition attracted by far the most attention. Men of years of experience in scientific work were surprised at the knowledge of mechanical principles, electrical theories and practice, and other intricate subjects, which was shown by the boy exhibitors.

Skilled workers in carpentry, iron, and other crafts were no less astonished at the results attained by mere lads at bench or forge.

Cleveland has of late been putting a great deal of emphasis on technical training in its school work, as well as upon manual skill. Its technical high school is one of the finest, and most thoroughly equipped in the United States. Settlement houses and the Y. M. C. A. have also devoted much time to the study of arts and crafts and mechanical and scientific topics. So that the boys of Cleveland have been pretty thoroughly taught the advantage and dignity of doing things with their hands.

The Boys' Exposition, as it was called, grew out of the practice of holding small exhibits by those interested in this phase of boys' work. The Y. M. C. A. organizations, particularly, had done this for some time. Such exhibitions had always proved attractive both to the boys concerned and to all who took an interest in what they were doing. The logical step was an exposition, at which all the boys of the city, irrespective of class or affiliation, should have a chance to exhibit their work.

The exposition was held in the Grays' armory, one of the largest auditoriums in the city, and it was none too large. There were in the neighborhood of 2,000 entries. They included almost everything to which an active American boy could turn his brain and hand.

Electricity and airships were two lines of endeavor on which much work was spent. Models of airships of all sorts were scattered throughout the industrial department. There were monoplanes and biplanes of all forms.

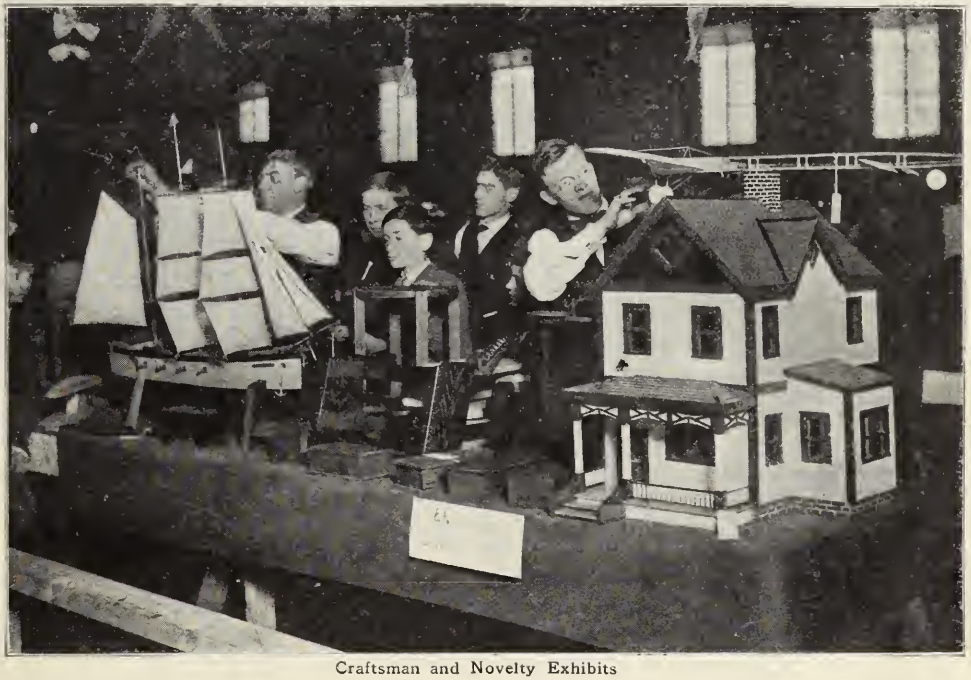
Wireless telegraphy was even more popular than aviation to judge from the number of exhibits of wireless apparatus. Many of these were practical instruments and had caught messages as they were shot from station to station along the Great Lakes. The mystery of the wireless made this section of the exposition one of the most popular of all with the visitors.

In connection with the electrical exhibit considerable attention was attracted by a device devised by a 15-year-old boy which permits a telegraph circuit to be intact and at the same time devoid of electric current. Electrical engineers who inspected the device thought it contained valuable pos-

sibilities and the young inventor will secure a patent for it.

Frames, gavels, trays, chairs, tables, stands and scores of other objects represented the work of the boys in carpentry and other crafts. The metal and forging department produced, among other things, knives, tongs, umbrella racks, lamps, castings and Venetian iron. In the electrical department, aside from the wireless instrument, entries were given. Entry A was for boys less than 13 years of age, entry B for boys less than 16 years of age, and entry C for boys less than 19. All the boys of the city were eligible. Many of them entered three or four different exhibits in the various departments.

The following partial list of the subjects for which prizes were awarded shows something of the scope of the exhibition:



Craftsman and Novelty Exhibits

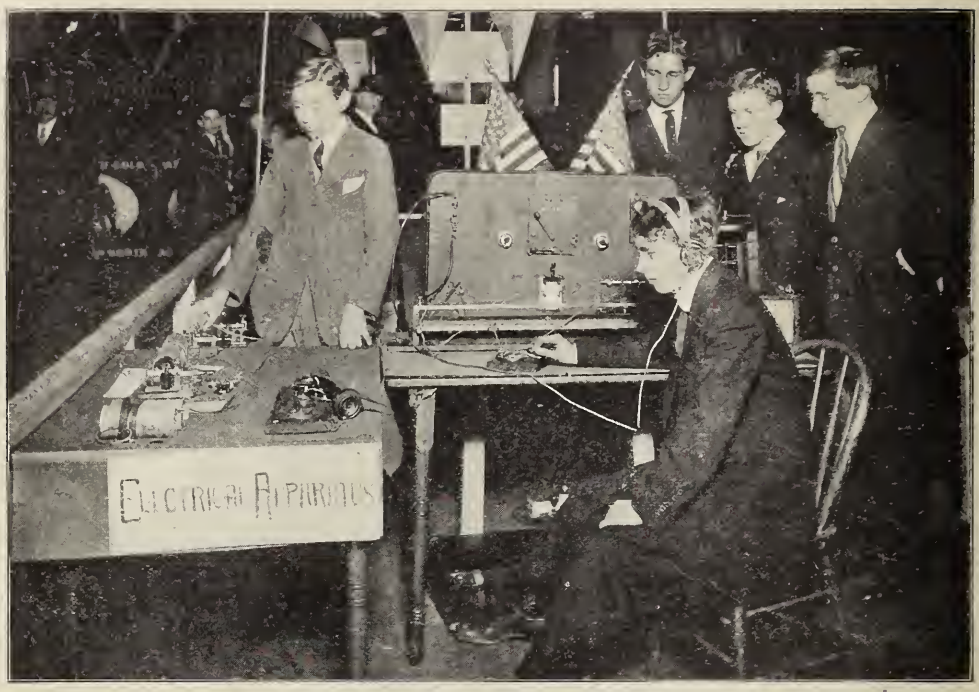
were half a dozen different forms of the telegraph, medical batteries, static machines and various forms of the telephone.

Though most of the exhibits were serious attempts at serious work, there were several of the novelty order which attracted attention. One lad appeared with a violin made from a cigar box and rigged with a single string. His instrument raised a laugh when he appeared, but he quickly got the attention of his audience when he began to play, for the queer little fiddle had a fine tone and the lad handled the single string with much skill.

First, second and third awards in all

Photography, motorcycle, coins, buttons, carpentry, broom holder, whisk broom holder, tie rack, T-square, picture framing, boxes, coat rack, sleeve board, book rack, magazine rack, tabourette, pedestals, book stalls, table, footstool, cabinet, model boat, aeroplane, iceboat, turning, gavel, darners, handles, burnt wood, china painting, Dutch dolls, lamps, amber carving, hammered brass, casts, Venetian iron, leather, copper, hatpins, rug weaving, pottery, putty modeling, and printing.

The expense of the exposition was not great, probably less than $1,000, and the small admission fee charged is expected to meet practically the entire



Part of Electric Exhibit at Cleveland Boys' Exposition

expense. Already plans are being laid for an even greater exposition next year. Those connected with boys' work in other large cities were much interested in the Cleveland exposition just held and many came to study it. It is probable that other cities will hold similar expositions the coming year, as manual skill and technical knowledge are coming to be considered an important part of modern education and the competitive idea contained in the exposition was held to be a valuable incentive to work along these lines.

AMERICAN GRANITE SENT TO THE STRONGHOLD OF SCOTCH GRANITE

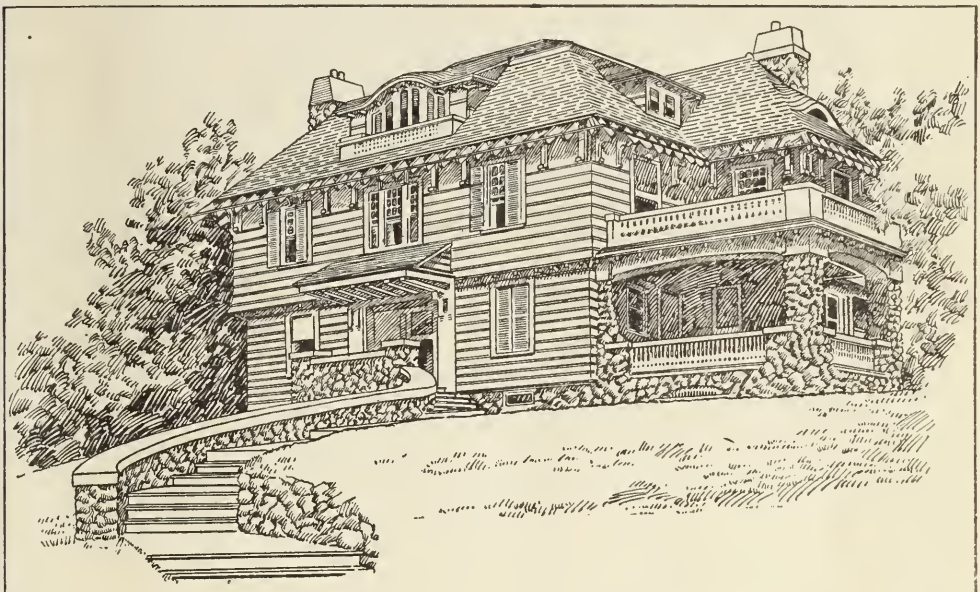
Regardless of the fact that Aberdeen is the home of Scotch granite, a granite company of that city has imported a large shipment of the stone from quarries in South Carolina. Why the Scotch company expects the venture to prove successful, regardless of the cost of transport across the ocean and the excessive cost of quarrying in the United States as compared with similar work in Scotland, is told by the following extract from an Aberdeen publication:

"It is expected that there will be a demand for the American granite because the trade is suffering badly from a scarcity of good grey stone for polished work. All foreign granite coming to this country is brought because there is a demand for a variation from native stones, and on account of special beauties in color. Photographs taken of the American quarry show a remarkable evenness of the granite, and it is pointed out that a block of almost any size could be procured." The first shipment of the granite consists of about 350 tons of blocks. If the experiment proves a success, a cargo of 1,000 tons is ready to be shipped.

¶Cocoanut mats have been provided for engineers and firemen on the Baden State Railways to prevent their hearing from being affected by the vibration of the engines.

OVERHANGING ROOF OF POLISHED PLATE GLASS

A residence at Waterbury, Conn., is of interest because of the novel use to which plate glass is put in the construction of the roof. An overhanging roof is a conspicuous feature of the exterior design, but the owner absolutely refused to have the second story rooms darkened by such a roof, and also disliked doing away with the overhang.



Roof with 2-Ft. Cornice of Plate Glass

Consequently, the architect and builders solved the problem by making the outer 2 ft. of the overhang of plate glass all the way around.

The illustration clearly shows the overhanging cornice of glass. The glass is carried on extended or false rafters. The shadows cast on the side of the house are made by the rafters, and they graphically illustrate what a difference in light would have been made by an ordinary non-transparent cornice, as all the space between the lines of shadow would also have been in shadow.

The glass was provided in plates about ¼ in. thick, 2 ft. long and 18 in. wide. Being highly polished, the surface is expected to keep comparatively free from accumulations of dirt.

AEROPLANE TIRES

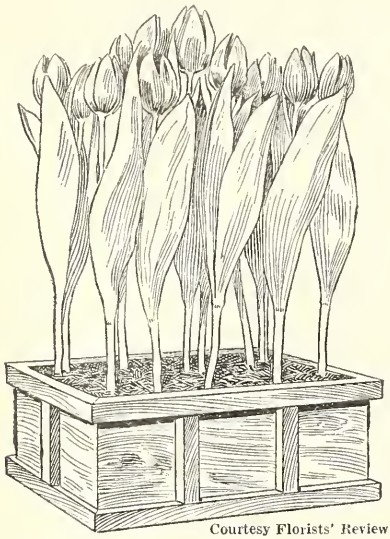
The demand for special tires for aeroplanes has grown so large in the last year that at least one big tire concern has made the providing of such tires a branch of the business and is finding a ready sale for the product.

The special requirements of aeroplane tires are strength, coupled with extreme lightness and resiliency. It must be strong for the work it has to do when the machine is on the ground, and yet so light that it adds but little weight.

¶The Wright brothers are endeavoring to devise a means of silencing the motor of their aeroplane. At present the throbbing of the engine can be heard half a mile away, a handicap for army use.

BOXES FOR TULIPS

The beauty of potted tulips is greatly enhanced by the nature of the receptacle in which they are placed. In this



Courtesy Florists' Review

Artistic Boxing of Tulips

illustration they are potted, or boxed, in a green-stained box. Such boxes are obtainable in many sizes or can easily be made, and go well with tulips of any color.

THE NEW QUEBEC BRIDGE

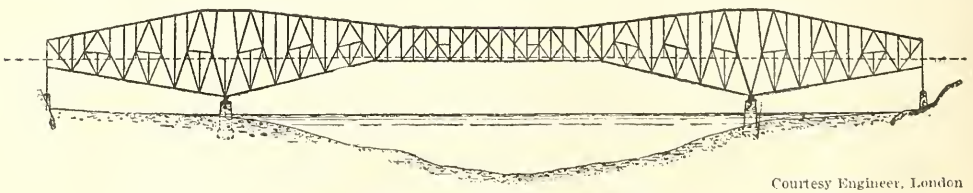
Following the fatal collapse of the partially completed Quebec bridge in 1907, which cost about 70 lives, a royal commission was appointed by the Canadian government. The result was that Canada had to pay for the ruined structure, and sometime later an English, a Canadian, and an American engineer were authorized to draw the plans for a new structure.

The general design prepared by the three engineers is shown in the accompanying drawing. The work of designing took about 18 months, and is said to have cost $150,000. The new structure will be 2,929 ft. long, the central span will be 1,758 ft. long, and the width of the bridge where it rests on the piers will be 88 ft.

In March, the London Engineer published an article stating that the commissioners were not satisfied, notwithstanding the outlay, with the design, and had invited competitive plans.

A curious feature of the new plan is that the bridge will not have a curved member in it. It is all straight lines, and the trussing is very peculiar, not being triangular in the ordinary sense of the term as applied to girders. The top and bottom booms are united by a series of "A's," inside of which is placed another of about half the height inverted. It will be remembered that the cause of the accident in 1907 was the collapse of a curved compression member in one of the shore spans, and this is one reason why the new plans do not incorporate a single curved member.

The width of the proposed bridge is said by both American and English technical journals to be insufficient. The width determines the stiffness of such structures against wind stresses, and it is claimed that the vibrations due to the narrowness might become excessive at high speeds and create danger of derailment of trains running over the bridge.



Courtesy Engineer, London

Design of Proposed New Bridge at Quebec

¶The amount of carbonic acid gas given off to the atmosphere of New York City by fuel combustion in a year is estimated at 400,000 tons.

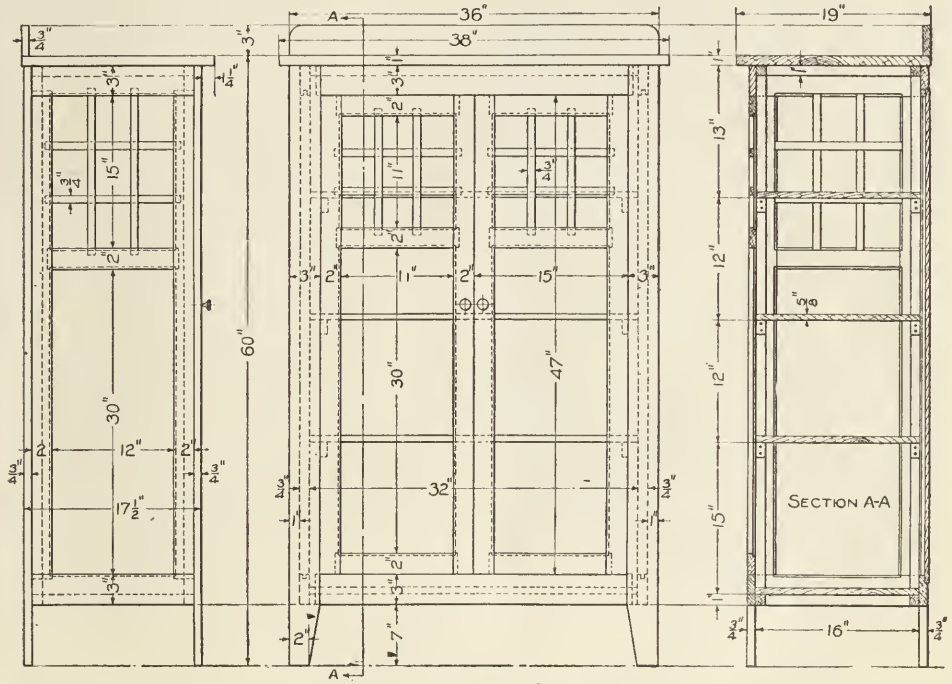
HOW TO MAKE A CHINA CLOSET

The china closet shown in the accompanying illustration is well proportioned and of pleasing appearance. It can be made of any one of the several furniture woods in common use, but quarter-sawed oak will be found to give the most pleasing effect. The stock should be ordered from the mill ready sawed to length, squared and sanded. In this way much hard labor will be saved. The following pieces will be needed:

1 top, 1 by 19 by 38 in., S-1-S.
4 posts, ¾ by 3 by 59 in., S-2-S.
4 side rails, ¾ by 3 by 31 in., S-1-S.
4 end rails, 1 by 3 by 16 in., S-2-S.
2 lattice rails, 1 by 2 by 13 in., S-2-S.
1 top board, ¾ by 3 by 36 in., S-1-S.
4 side door rails, ¾ by 2 by 47 in., S-2-S.
6 cross rails, ¾ by 2 by 12 in., S-2-S.
4 slats, ½ by ¾ by 16½ in., S-2-S.
4 slats, ½ by ¾ by 13½ in., S-2-S.
8 slats, ½ by ¾ by 12½ in., S-2-S.
4 shelves, ⅝ by 16 by 32 in., S-1-S., poplar.
4 cleats, 1 in. sq. by 55 in., soft wood.
4 cleats, 1 in. sq. by 28 in., soft wood.
4 cleats, 1 in. sq. by 14 in., soft wood.

Having this material on hand, start with the four posts, as they are all alike. Clamp them together, being careful to have them of the right length, and the ends square. Trim the bottom, as shown in the detail drawing, and then lay out the mortises for the front and back rails. These rails can now be laid out and the tenons cut to fit the mortises in the posts. The back rails should, in addition, be rabbeted for the back board as shown. The end rails are fastened to the posts by means of screws through 1-in. square cleats, fastened on the inside of the posts as shown in the section A-A. In all cases the screws should be run through the cleats into the framing so the heads will not show. The end rails should be rabbeted on the inside for the latticework and the glass.

The back board should have the corners rounded as shown and be fastened to the top board with screws through from the bottom side. The top board is then fastened to the top rail cleats in the same manner.



Details of China Closet Construction

The doors are put together by means of tenons and mortises. The frames should be rabbeted on the inside for the latticework and the glass. Leaded glass can be used in place of this lat-

China Closet Complete

ticework if it is desired. Suitable hinges and a catch should be supplied. These can be purchased at any hardware store.

The shelves should be cut out at the corners to fit around the cleats. They rest on small blocks which are fastened to the cleats, or if desired, small holes can be drilled and pins used instead.

The back is put on in the usual manner. A mirror can be put in without much trouble if it is desired.

When putting the frame together, glue should be used on the joints, as it makes them much stiffer. Be careful to get the frame together perfectly square, or it will be hard to fit the doors and the glass. When it is complete, go over the whole carefully with fine sandpaper and remove all rough spots. Scrape all the surplus glue from about the joints, as stain will not take when there is any glue. The closet can be finished in any one of the many mission stains supplied by the trade for this purpose.

A FLOATING RUSSIAN EXPOSITION

One of the most novel and ingenious expositions ever devised was the floating exhibit arranged on a steamship by the business interests of Russia for a visit to the ports of the Black and Mediterranean seas. The floating exposition started from Odessa, going first to Yalta to be formally opened by the Tzar, after which it visited 24 ports, remaining from 1 to 12 days at each, according to its importance.

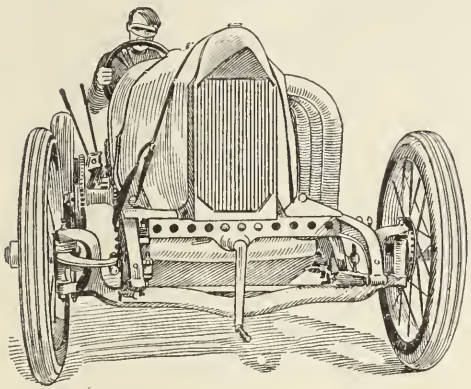
Over the hatchways of the vessel were erected fancy tents, while hemlock and pine trees were arranged about the deck. The ceilings of the holds of the vessel were specially painted and ornamented, and the many display sections were lighted by electric bulbs in beautiful chandeliers. Goods, samples and agents from 133 Russian firms were on board. The exhibit was varied, including fine silks woven with gold and silver, such as are used for ecclesiastic purposes; cloth goods of all kinds, especially woolen goods and printed cotton; gold, silver, and jeweled articles for churches; household furnishings and utensils; lumber and mining exhibits; photographs, plans, and models of railroad engines, cars, river boats, marine engines, and bridge work; electric dynamos and ice machines in operation; farm implements, and other exhibits covering a wide field of occupations and industries.

¶A taximeter for use on public vehicles, now being tested by the London authorities, issues a ticket at the end of the journey stating the amount of fare due.

MASSIVE AXLE OF OLDFIELD'S RECORD-MAKING CAR

The average automobile enthusiast would naturally expect that the axles and other parts of racing cars would be light. The front axle of the huge 200-hp. Benz racer with which Oldfield made the new world's straightaway record of :27.33 seconds for the mile proves the contrary.

If the speed of an automobile is doubled, the stresses which will be set up in the component parts will be quadrupled, and, according to the Automobile, an axle that would be quite satisfactory at 30 miles per hour, would have to work four times as hard at 60 miles an hour, and 16 times as hard at

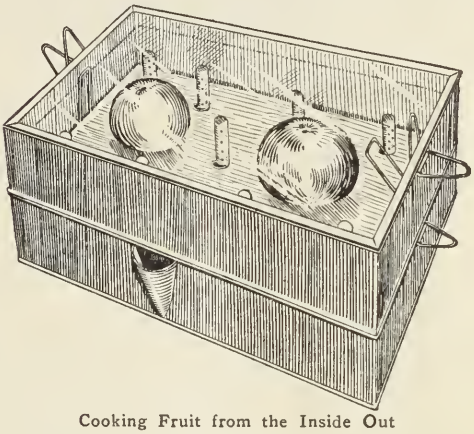


Front View of Record-Breaking Car, Showing Massive Axle

120 miles an hour. That the relatively enormous amount of metal used in the front axle of the Oldfield car is a nearer approach to correct axle proportions for racing cars than relatively light axles is proved by the large number of axles that have failed under racing conditions.

COOKING APPLES FROM INSIDE OUT

Apples and other fruits of like nature are usually cooked from the outside in, that is, the heat cooks the outside first and gradually penetrates to the center. With this cooker the procedure is reversed. It consists of two vessels, a lower one for receiving the water, and an upper one for steaming the fruit. From the lower vessel the steam passes up through small capped



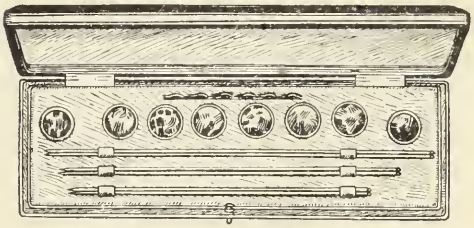
Cooking Fruit from the Inside Out

cylinders, or cones, perforated with tiny holes. The apples, after being cored, are impaled on these cones, and are cooked from the inside as the steam rises.

The upper vessel is covered with glass, so that the cooking operation can be watched. The cooking cones rise from a tray, which may be lifted out with the fruit attached.

HATPINS WITH DETACHABLE HEADS

An ingenious English jeweler has devised a hatpin with a detachable head, so that different lengths of pins can be used for different hats and coiffures.

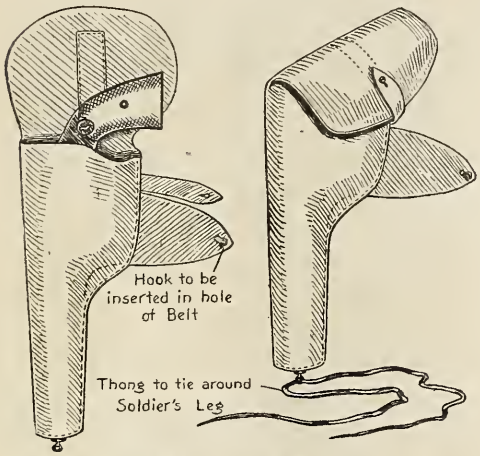


Hatpin Set with Detachable Heads

They are sold in sets of six pins and eight heads, the pins being three different lengths. The heads are in different colors of mother-o'-pearl, or imitation jewels, so that the wearer has the choice of colors for different hats.

REVOLVER HOLSTER PROVIDED WITH SPRING FLAP

The War Department insists upon a holster with a flap to protect the revolver from the weather and to prevent



Spring Flap Closed and Open

loss of the weapon. The fact that this flap is greatly in the way when drawing or returning the weapon, because it retains the shape in which it is buttoned and remains folded over the top, has led the department to devise a holster provided with a spring flap. A flat spring, working in a pocket on the under side of the flap, bends when the holster is buttoned, and causes the flap to fly open and remain in a vertical position when unfastened.

The act of drawing the revolver from a holster provided with this spring only requires a downward movement to release the button and an upward movement to draw out the revolver, while the same procedure with the holster now in use requires four movements. During the Spanish war the cavalry soldiers adopted the expedient of tying the flap open before going into an engagement, in order to have the revolver ready for instant use.

The new holsters are also to be provided with a thong that passes around the leg from a button at the base, thus keeping the holster from flopping when riding hard.

MAKING MOVING PICTURES IN EXCESSIVE TEMPERATURES

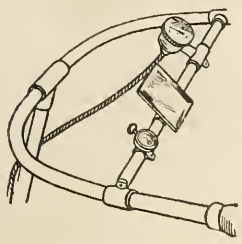
Making moving-picture films in a temperature of 34 below zero is only possible by exercising the utmost care and ingenuity, yet considerable work of this nature was successfully carried out recently in the northern latitudes.

Such temperatures render the films as brittle and fragile as glass, making it almost impossible to reel them on the spool inside the magazine. The films were kept in blankets, which, in turn, were kept as warm as possible by artificial means. They were taken out of the blankets just a moment before their using. Developing was impossible.

As a contrast to these conditions were those of just the opposite extreme met in India. The general tendency there was for the emulsion of the films to run and the material to become gummy. The films had to be packed in air-tight, wax-sealed tin boxes. More than once the camel or elephant used to carry the supplies showed indications of a desire to take a bath by wallowing in deep pools, film packs and all.

HANDLE-BAR ARRANGEMENT CARRIES ACCESSORIES

The motorcycle provides but little room for the carrying of even needed accessories, but by this handle-bar attachment at least three of these necessities are taken care of in a very practical way. A small piece of tubing stretches across between the bars, and on this is clasped a speedometer, a watch, and a map carrier. All three are in the best possible position for the rider to glance at them.



¶Sanitary engineers are now considering the advisability of using ozone for flushing and disinfecting sewers.

THE DEVELOPMENT OF THE CRUDE OIL ENGINE

WHILE comparatively little attention has been paid to the crude oil type of internal combustion engine in the United States, the general interest being centered in the gasoline engine, it has been making great headway in Europe, where thousands of engines using the coarser oils are in operation.

But even in this country it has been encroaching into the field of the gasoline type, and, according to its ardent supporters, will supersede it for many purposes. Crude oil engines, aggregating approximately 500,000 horsepower, are in service in this country at the present time, principally in the south and west. The fact that the source of the fuel production is close at hand is said to be partially responsible for its popularity in those sections.

The United States geological survey, recognizing the increasing use of the engine, is preparing to make an extensive investigation into its merits.

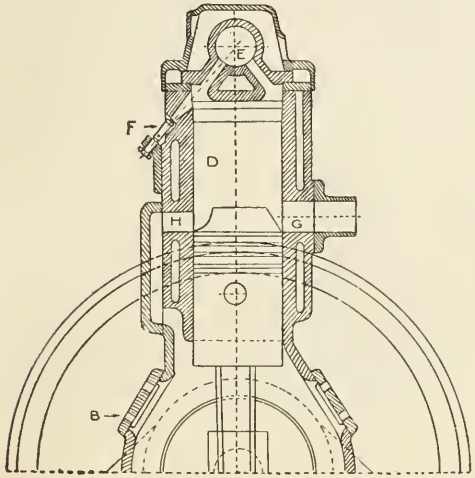
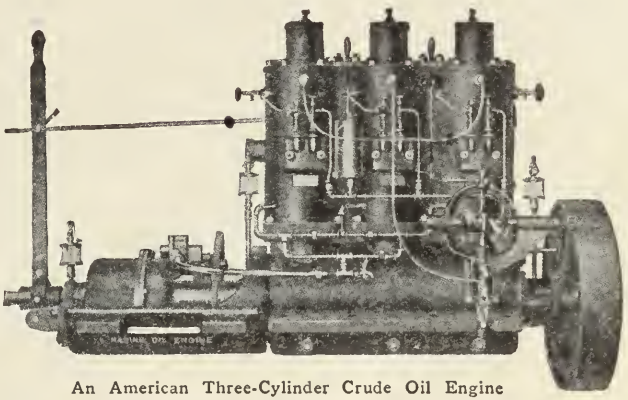


Diagram Showing the Special Construction of Combustion Head

To this end a large amount of chemical work on oils has been in progress.

Economy is the great advantage claimed for the engine. Oils costing three or four cents a gallon have been used with very satisfactory results with some of the American makes. For many years the problem of burning crude oil successfully in an engine baffled engineers. Now the crude oil engines are being adapted for many purposes, having proved especially fitted for marine work. No attempt has been made as yet to supplant the gasoline engine in automobiles, however.

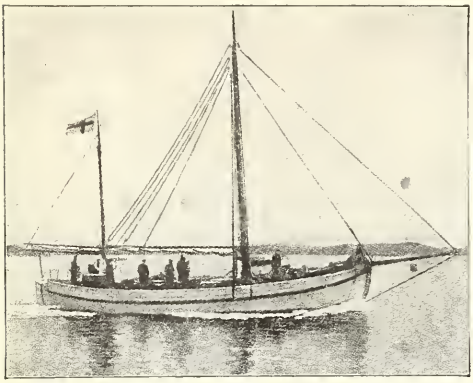


An American Three-Cylinder Crude Oil Engine

It is only a few years ago that a round-bowed fishing boat of the Swedish type visited some English ports, and created somewhat of a sensation. She was fitted with a heavy oil motor, and was sent by Swedish manufacturers to demonstrate the merits of the crude oil engine to English shipbuilders. "Bolinders VII" was the name of the craft, and that her errand was well carried out is attested by the manner in which the crude oil engine was adopted and developed in England.

In addition to its economical operation the engine has the advantage of being extremely simple as internal combustion engines go. No slide valve, electric or tube ignitor is used, the ignition being effected by compression. It requires a longer time to start than the gasoline engine, for it requires the heating by a kerosene burner of what

is called an ignition bulb or ball, located in the cylinder head, before combustion can commence. This bulb or ball is marked E in the accompanying



The "Bolinders VII," the Swedish Fishing Craft Used to Demonstrate the Merits of the Crude Oil Engine

diagram. Once started by the burner, it is kept hot automatically.

In one of the more simple types, a cross-section diagram of which is shown, the oil is injected directly into the bulb at F, and assisted by the action of the baffle plate on the top of the piston, circulates through the bulb, and surges into the cylinder head, D, through the passage E. The air-intake ports B in the crankcase C are provided with leather flap valves. The port H of course, leads to the cylinder, G being the exhaust port.

The engine receives an impulse at each turn of the crankshaft. The air and fuel injection, the compression and burning of the mixture, and the explosion of the exhaust, are all performed at a single turn in the most direct and simple method.

In most of the engines of this type now manufactured a vaporizer is provided. The system of vaporization is in reality a distillation in which the heavy asphaltum base is rejected in the form of tar, and is discharged automatically. Any small percentage of ash is retained in the vaporizer, from which it can be easily removed with an ordinary wire brush. Some makers guarantee that even such oils as turpentine refuse, creosote, shale oil, Scotch fuel oil, Texas liquid fuel, or lubricating oil can be successfully used.

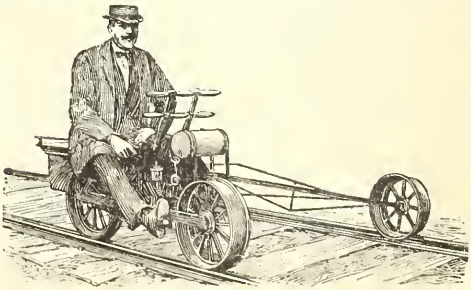
SALT RIVER FLOWS INLAND FROM THE SEA

A current of water will flow back and forth in a tide-water river, but on the Island of Cephalonia, near Greece, is the curious phenomena of a river steadily flowing inward from the sea and disappearing. All rivers naturally flow towards the lower levels to the sea and this curious instance on the island in the Mediterranean is not duplicated anywhere else in the world, so far as is known.

The sea, which is almost tideless, enters the land at four points where the coast is practically on a level with the surface of the sea. These four streams unite to form the little river that flows inland until it finally disappears in the limestone rocks and sinks into the earth. The volume of the river is too great to be removed by evaporation, and the question is where does it go?

PHYSICIAN USES MOTOR SECTION CAR

A motor-driven section car is the means by which Dr. Philip Stephens, of Caliente, Nev., visits his patients. He is district surgeon for a railroad in a valley 100 miles long, and can reach practically all the towns and ranches in his vicinity with his railroad automo-



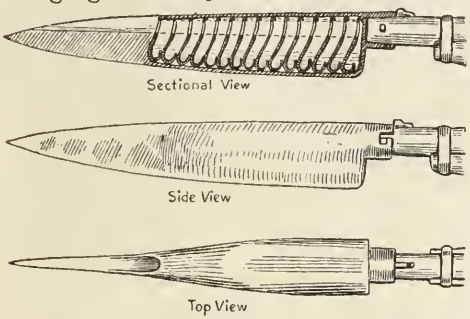
Courtesy Journal Am. Med. Assn.
Nevada Physician Starting on a Call

bile. He uses it for both railroad and private calls, makes a speed of 30 miles an hour, and is never bothered by muddy roads or punctured tires.

COMBINATION SILENCER AND BAYONET

The latest type of silencer for use on military rifles is a combination silencer and bayonet, designed to meet and overcome the two serious objections to the device brought out by Maxim. These objections were based on the added weight, and the necessity of interchanging the silencer and bayonet.

The combination silencer and bayonet is of the disk type, having a series of disks within a cone, curved so as to retard the escaping gas and cause it to leave the silencer with a circling motion. The bayonet is made by extending the lower part of the silencer and bringing it to a point. The bullet, in



Construction of Combined Silencer and Bayonet

leaving the silencer, passes just above the top of the bayonet blade.

PRIMITIVE INDIAN SCULPTURE REPRODUCED IN MARBLE

The burial places of the Indians exclusively inhabiting the northern part of Vancouver Island, British Columbia, abound with monuments remarkable in their primitive design and the modern monumental workmanship expended upon them. Although clinging to the ancient beliefs of the race, and the type of sculpture with which the race expressed these beliefs in the carving of totem poles during the hundreds of years of the past, the present generation of Indians have recognized the superiority of marble and granite over wood and sought out a modern monument maker.

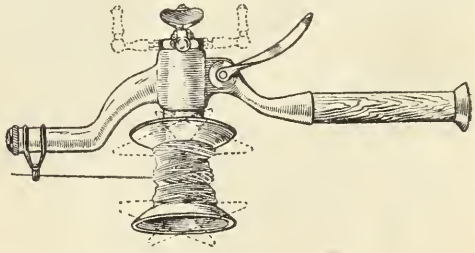
They first whittle the models out of soft pine logs, then, instead of painting them in gaudy colors, take them down

Indian Monuments Reproduced in Marble and Granite

to Victoria to be reproduced in either marble or granite. They often, however, paint the marble or granite after setting the monuments up.

GYRATORY FISHING REEL

This gyratory reel is so named because the spool not only rotates, but performs eccentric gyrations, the purpose of which is to cross-wind the line so that it cannot tangle. It is applying to the reel the winding principle employed in winding a ball of twine by hand, and it cross-winds the line without the aid of hand or a compli-



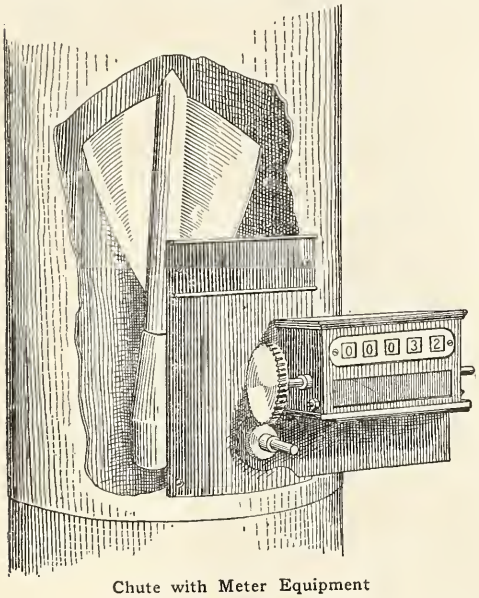
Ingenious Fish-Line Reel

cated spool. When the line is being cast, no part of the reel is in motion except the spool itself.

¶Black River Falls, Wis., has placed cuspidors along its streets to prevent the spread of tuberculosis.

METER MEASURES COAL DISCHARGED BY CHUTE

A meter that sits inside a chute and measures the amount of coal passing through it has been designed by an



Chute with Meter Equipment

inventor of Scranton, Pa. The meter itself is simple, consisting of vanes attached to a spindle. These vanes are caused to rotate by the movement of the coal down the chute, and the revolutions are transmitted to a counter outside the chute by means of bevel gear. By weighing a small quantity of coal passing through the chute, and counting the revolutions of the meter, it is possible to adjust the counter to register in tons, hundred-weight or other units, as desired. The chute, however, must constantly remain filled with coal so that the vanes are always entirely submerged.

The apparatus can also be used for measuring grain in elevators, and for other products handled through pipes or chutes.

¶Notwithstanding the addition of many bridges and tunnels at New York, there are 130 ferryboats in commission.

BOLIVIA A RICH GOLD FIELD

Rich gold resources still untouched in Bolivia, provide, according to Alexander Benson, secretary of the U. S. legation at La Paz, excellent prospects for an American gold dredging enterprise.

"It has been known for some years," says Secretary Benson, "that the interior of Bolivia is one of the richest unexplored gold fields in the world, and experts of wide experience have prophesied that once this country is opened up, it is likely to be the center of the world's gold supply. The immense difficulties, however, that have beset the steps of explorers and prospectors have left these regions practically untouched by modern miners.

"Since the times of the Incas, rough trails have existed between the ancient Inca centers of Titicaca and Cuzco and the deep forest-clad ravines of the Eastern Cordilleras. The most important of these precipitous valleys have been formed by the Tepuani, Mapiri, Challana, and Coroico rivers. The ancient trails leading into these valleys were built by the Incas for extracting gold from the immense deposits of gravel existing in every one of these valleys.

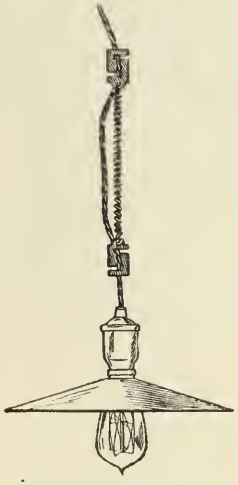
"The origin of so much gold is still a matter of conjecture. It is probably derived from two principal sources. The first is the many ancient glacial deposits in the high Cordilleras, a large proportion of which carry gold in varying quantities. Nuggets weighing as much as 52 oz. have been washed out, and it is on record that a huge mass of gold weighing 50 lb. was taken from one mine in former times by Spaniards. The second source of gold is in the numerous veins of quartz that run in every direction. These veins are mostly too narrow and patchy for profitable working, but they are both rich and numerous.

"In any of the rivers mentioned it is rare that a pan of gravel, even from the surface of the river bed, fails to wash out at least a trace of fine gold, and it is not uncommon to wash a pan

of surface dirt and find gravel averaging a dollar a yard on the surface. This would indicate enormously valuable deposits below. The upper rivers, difficult to work because of the great boulders with which they are strewn, their torrential nature, and the mighty floods which sweep their course each year, form the river Kaka just below Guanay. This river receives gold bearing gravel that never had a chance to settle in the turbulent torrents of the higher hills, and the operation of a dredger would be perfectly feasible on parts of it."

SPRING SHOCK ABSORBER FOR TUNGSTEN LAMPS

A simple but effective shock absorber for tungsten lamps is shown in this drawing. It is a spiral wire spring, provided at both ends with a metal device that engages with the flexible wire.

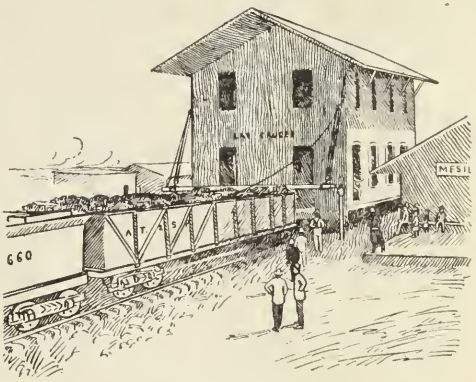


¶Ice wagons and automobiles seem to be about the extremes in vehicles, yet motor ice trucks have made their appearance. Four of them have just been placed in operation in Cincinnati, Ohio.

MOVING A DEPOT ON ONE CAR

A 2-story frame depot, 20 by 40 ft. was recently moved intact on one flat car from Las Cruces to La Tuna, New Mexico, a distance of 24 miles. It was loaded onto a 40-ft. car. It rose to a height of 30 ft. above the rails.

To allow of its passage it was necessary to take down all switchboards, whistling-posts and overhead wires en route, and to move the track out 2 ft. at one point to allow it to pass another station. A loaded coal car was attached to each end of the car on which the depot was placed, stringers were fastened to the ends of the cars, and lines were run from the stringers to the second story to brace it, thus making a base of practically 120 ft. The car springs were blocked and made as rigid as possible.



Depot Loaded on Flat Car

The 24-mile trip was made in six hours.

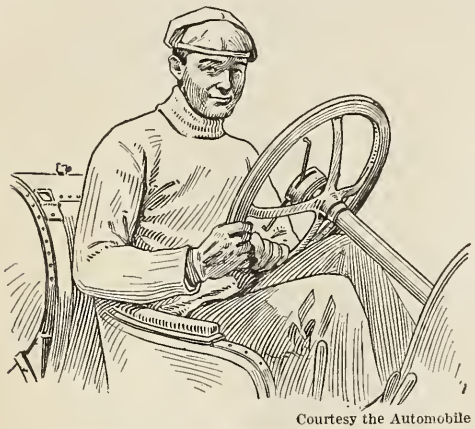
THE LAST OF THE SIX-MASTED SCHOONERS

The great six-masted schooners, now so numerous in Boston harbor, are no longer to be built, according to marine men of the Atlantic coast. Within the past few months the Coastwise Transportation company, the concern which built the 8,000-ton "Thomas Lawson," wrecked about two years ago, decided to build steam vessels in the future. It is also significant that, while 43 sailing vessels, 38 of which were schooners of 300 tons gross register, were lost on the coast last year, only eight new schooners were constructed.

The 3-masted and 4-masted schooners, however, according to the same authorities, may stay for a long time yet, as the smaller and shallower New England harbors will not accommodate the steamships.

CORRECT HOLDING OF AUTO STEERING WHEEL

There are several excellent ways of holding an automobile wheel, as well as many very awkward ways, but the



Courtesy the Automobile
How Racing Drivers Hold Steering Wheel

way the wheel is grasped by racing drivers is probably the best to pattern after. It will be conceded, despite their apparent recklessness, that the racing drivers handle the steering wheel in the best possible manner.

As may be seen by this illustration, the right hand firmly grasps the rim just below the horizontal center, with the forearm in a horizontal position, describing a right angle. The left hand is just below the right in the same sectional space made by the spokes of the wheel.

The worst possible ways to grasp the wheel are above the horizontal center, and at diametrically opposite points. The arm muscles under such conditions are at a great disadvantage, and body bracing is almost impossible.

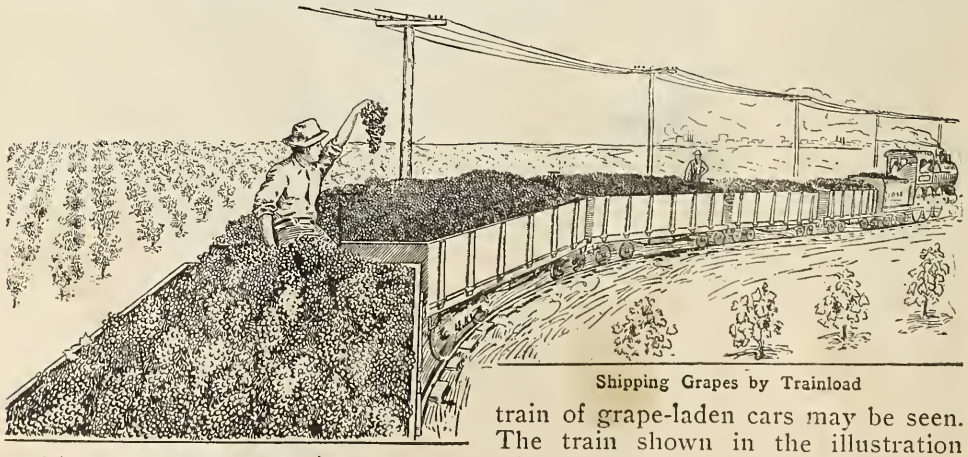
MOVING PICTURES OF RIOTS AS EVIDENCE

During the traction strike in Philadelphia one or more film manufacturing companies had their men in the streets taking moving-picture productions of the scenes of rioting. These films were for ordinary display in the moving-picture theaters, but the police authorities, according to one source of information, will have detectives watching them whenever exhibited.

The police believe the films may be valuable as crime detectors. They may show men throwing bricks that seriously injured other persons, or the police may be able to identify strikers the moving pictures show wrecking street cars or assaulting strike-breaking car operators.

A TRAINLOAD OF GRAPES

Grapes are shipped by the carload from the irrigated districts of California to the wineries, and often a long train of grape-laden cars may be seen. The train shown in the illustration might be taken for a gravel train were not the reader told that the load consists of grapes.



Shipping Grapes by Trainload

CURIOUS BATHS IN PENANG HOTELS

One of the many things that strike the tourist as curious at Penang is the type of baths with which the hotels are provided. Penang is in the Straits Settlements, a British crown colony in the Malay Peninsula, deriving its name from the Straits of Malacca, which forms the great trade route between India and China. From each of the first-class rooms opens a dark, cement-paved, damp-smelling little room which serves as the bath. In it is an immense jar of porous brown earthenware, about 5 ft. high, nearly 3 ft. in diameter in the middle, and but 1½ ft. in diameter at the top. It stands huge and graceful of outline, but dark and uninviting, and is full to the brim with water, not, however, to get into. Near it is a supply of soft soap and a long-handled quart dipper. The proper procedure is to soap the body well, then throw several dippers of water over it, repeating the process until satisfied. There is water enough to keep it up for an hour or so, and a huge crash towel, as large as a sheet, to wrap up in when the bath is over.

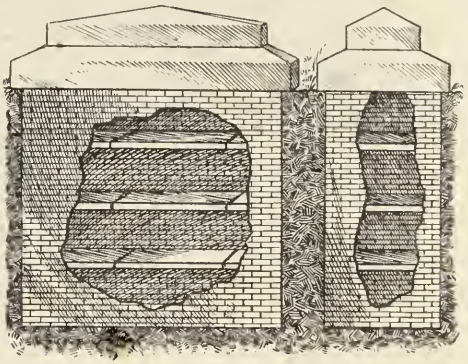
GERMANY'S AERIAL DASH TO THE POLE

Steady progress is being made in Germany for the dash for the North Pole in a Zeppelin airship in 1912. At present the committee of the expedition is inviting the general public to assist in furnishing the funds for a great dirigible garage at Hamburg. Its cost will be $250,000, about $150,000 of which has now been raised. When it is completed, two specially constructed dirigibles will use it as a base for a number of experimental cruises over the ocean.

Following these cruises the airships will, it is expected, be transferred to the Arctic zone in 1912. The dash for the pole will then start from Spitzbergen. Prince Henry of Prussia expects to accompany the expedition to that point.

BRICK GRAVES OF PHILADELPHIA CEMETERY

This illustration shows the construction of the three-crypt brick graves



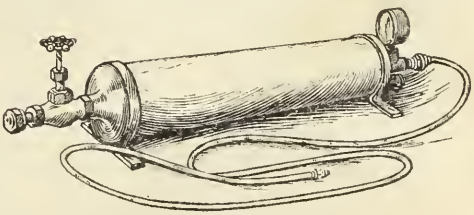
Side and End Views of Three-Crypt Brick Grave

built at a Philadelphia cemetery. The brick walls extend to the surface of the ground, and are capped by a stone. Stone slabs divide the interior into coffin compartments. The material used in construction is either hard red brick, or enameled brick.

TIRE INFLATOR CHARGED BY ENGINE'S EXPLOSIONS

This cylindrical tire inflator, carried on the running-board of the automobile, is connected with one of the cylinders of the engine, so that with every explosion a part of the exploded gases enters the tank, thus maintaining a constant pressure in it.

The connection between the tank and cylinder is a ⅜-in. copper tube, provided with a check valve, which pre-

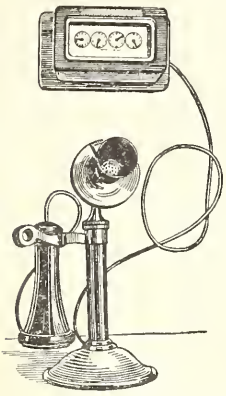


New Form of Tire Inflator

vents the gas backing up into the cylinder. Within the tube is a filter which is claimed to remove the oil from the gases.

CHARGING BY METER FOR TELEPHONE SERVICE

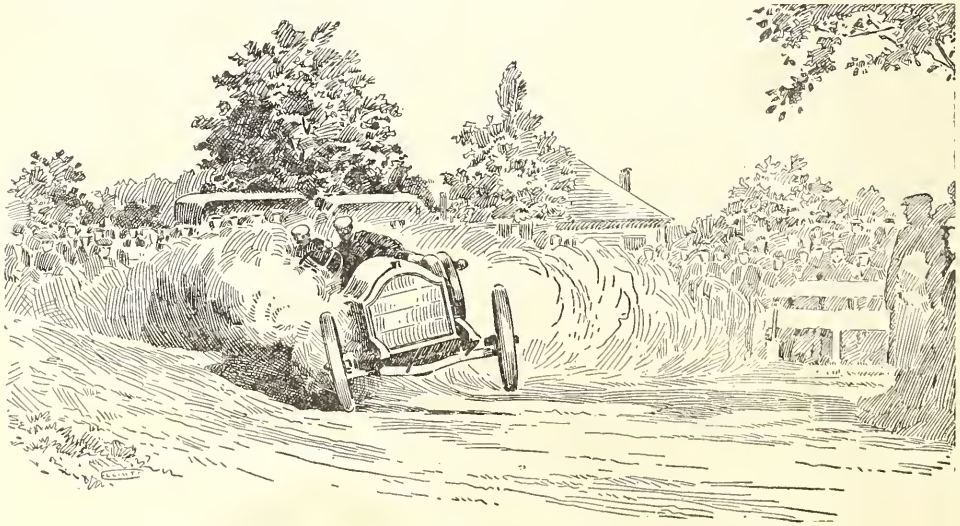
This illustration shows the meter of a system by which telephone service may be charged for in the same manner as electric light and gas. When the user of a phone so equipped removes the receiver from its hook and gets connection with central the meter begins to register, and continues to do so until the receiver is again placed on the hook. The charge for the call is ordinarily made on the meter of the phone from which the call is made, but, if desired, may be reversed by consent of the receiving party. The subscriber can read his meter, and thus at all times has full control of the economy of his service.



This means of charging for telephone service was studied with much interest at the last convention of the National Independent Telephone Association in Chicago. The flat yearly rate for unlimited service which is still in vogue in many cities, is said to be impracticable in large exchanges, as it places upon the telephone company the burden of handling a large per cent of frivolous and unnecessary calls. The measured service rate was adopted to overcome this nuisance, but even this has proved only fairly satisfactory. By this system a charge of a few cents is made for each outgoing call, plus a small fixed annual payment. A talkative person, however, might occupy a circuit for half an hour for the payment of one fee, while in the same period a business man might make a dozen calls, for which he would be charged 12 times as much.

INSIDE WHEELS RISE IN MAKING TURN

The general impression is that the outside wheels of a racing automobile rise when a sharp turn is being made at high speed, but according to this illustration and the accompanying data it is always the inside wheels that leave the ground. Writers in automobile magazines have again and again tried to impress the general public with this fact, and have filled much space in telling what this photograph shows so clearly.



Inside Wheels Leaving Ground in Turning

The photograph was taken when Knipper was making a turn in the last Vanderbilt cup race. The car is shown coming from the extreme right, although the casual observer would think it had come from the left. The high embankment seen on the left, however, would soon dispel this idea. Why the inside wheels lift from the ground is explained as follows by the Chalmers Co. of Detroit:

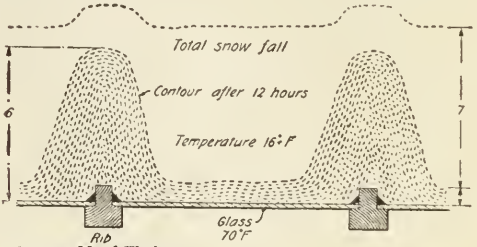
"In running on a straightaway a car gains momentum in proportion to its speed. It also loses what is known as inertia; that is, were the power suddenly shut off, the car would continue to travel in the direction in which it was going until the momentum was overcome by inertia. In science inertia is also that quality which impels a moving object to continue its line of motion when the mechanical impetus is removed. In the case of a motor car rounding a turn the power is not shut off, but the force of inertia which tends to keep the car traveling in one direction is suddenly shattered. The impetus given by the motor compels the car to continue its momentum around the turn, but in overcoming the force of inertia the car tips. When the car shown in the illustration made the turn, the tendency was to follow its former direction from right to left, and the inside wheels left the ground. A car always follows its earlier motion in tipping, so that the inside wheels always are those which come off the ground."

ELECTRIC AND STEAM LOCOMOTIVE RIVALS

The accompanying illustration gives a comparison in size of steam and electric locomotives of equal capacity. The electric locomotive is a powerful machine for the hauling of passenger traffic on the Simplon Tunnel railroad in Switzerland. The total length of the road is 13 miles, the tunnel itself consisting of nearly the whole of this. The electric locomotive will operate at four speeds, 15, 21, 33, and 43 miles an hour, the corresponding horsepower being 550, 650, 750, and 850.

HEAT LOSS THROUGH GLASS

The relative transmission of heat through glass and through wood is well illustrated in this drawing of the condition of snow on the top of a greenhouse roof some 12 hours after the snow began to fall.

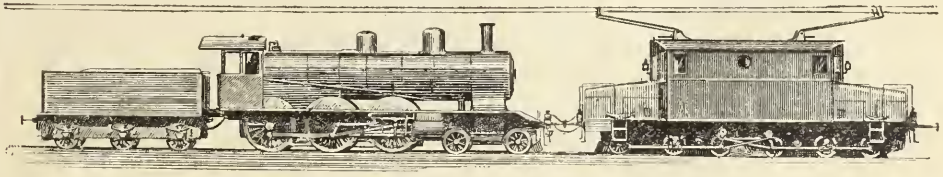


Courtesy Metal Worker

Snow on Greenhouse Roof Shows Relative Heat Loss Through Glass and Wood

The total snowfall is shown by the dotted line across the top. After the 12-hour fall the snow above the 2-in. thick wooden ribs of the roof was 6 in. deep, and only about 1 in. deep over the greater part of the glass surface. The loss of heat through the glass was five times as great as the loss of heat through the 2-in. wooden ribs.

¶The Zurich Corporation, which governs the famous Swiss community, has decided to grant no further licenses to gasoline cabs, holding that electric cabs can be operated as efficiently and economically without the noise and odor of the gasoline vehicles.



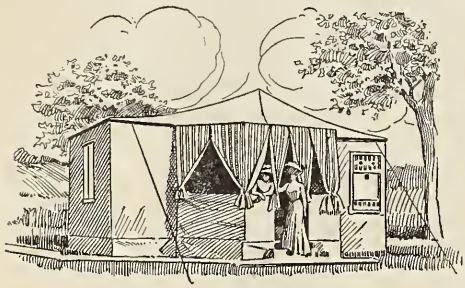
Steam and Electric Locomotives of Equal Capacity

AUTOMOBILE IS PORTABLE HOUSE

An artist of Coburg, Germany, is touring the southern part of that coun-

ly for the Road

try in a remarkable automobile which he converts into a summer house when he wishes to linger in a certain locality to paint. When running on the road it would resemble a large motor moving-van were it not for the curious window-section in the front. This, as one illustration shows, forms a dust and rain protection for the driver, while in the other illustration, which shows the



Converted into Summer House

machine transformed into a house, it is seen as a bay-window at one end.

As a house, the curious outfit boasts of a living-room, a bed-room and a kitchen.

THE WORLD'S DREADNOUGHTS

The activities of the navies of the world in building Dreadnoughts and the comparative strength of each in such ships is shown by the following figures: England has 12 completed, 2 launched and completing, 8 building or ordered, and 8 projected, making a total of 30. Germany has 4 completed, 5 launched and completing, 4 building or ordered, and 4 projected, making a total of 17. The United States has 4 completed, counting the "Michigan" as a Dreadnought, 1 launched and completing, 3 building or ordered, and two projected, making a total of 10. Japan has 5 completed, 1 launched and completing, 2 building or ordered, and 2 projected, making a total of 10. France has 6 launched and completing and 2 projected, making a total of 8. Austria has 3 launched and completing, but neither Italy, Russia, nor Spain has any.

MOTORBOAT GARAGES

Now that motorboats are as numerous in favorable water localities as are automobiles on land, the practicability of the motorboat garage as a paying business is becoming more and more assured. Probably not more than a tenth of the motorboat owners belong to clubs which have facilities for taking care of their craft.

That such garages, centrally located and properly equipped, are a good investment has been proven by the success of the few already in operation. One of these is in Pittsburg, and today it is taking care of from 300 to 400 boats, while a garage at Baltimore netted its owner more than he put into his outfit within five weeks after it was started.

A successful motorboat garage, according to the Nautical Gazette, must be able to haul a launch from the water and put it back again. It must have room for working on from 12 to 20 launches at one time without interference; handy machine, carpenter, and paint shops; a complete stock of marine hardware; a gasoline supply, and ample room for the safe mooring of a large number of boats.

¶Although Germany has clung to its faith in the dirigible for many years, its military authorities now recognize the superior effectiveness of the aeroplane.

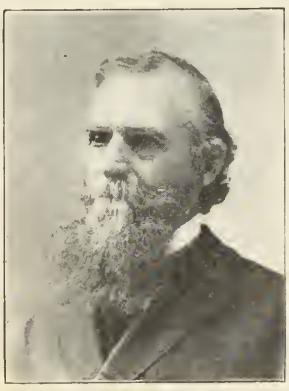
Men of Tomorrow at the Glenwood School

A Farm for Raising Ambition

By JAMES R. QUIRK

ONCE upon a time there was a man who owned three hundred acres of land. It was a beautiful piece of ground, far better to look upon than the average farm, even in Illinois. It contained an orchard, some handsome shade trees, and through it there flowed as picturesque a little stream as ever rippled its way through a poem.

The owner of the land, who was then an editor, had been a farmer, and he dreamed of great crops which would be produced upon it. The crops he dreamed of were not wheat, nor corn, nor hay, but crops of ambition and character in the souls of dependent boys—boys who, because of force of circumstances or the influence of an unfortunate environment, needed just a little material help and a little inspiration to turn their steps in the right direction at the critical point in their lives.



Milton George

He saw the need of providing for a class of youngsters who are the result of every large, complex community such as the city of Chicago—not delinquents, but dependents because of the vicissitudes of life or the negligence of parents. It would be little short of criminal to send these boys to a reform school to consort with juveniles steeped in crime and aged in viciousness. It would break their spirit to send them to an institution such as the ordinary orphan asylum. Left to their own resources, some of them would, in all probability, develop into the type that is such a familiar and sorry sight in every large city—the floater, the corner loafer, or perhaps a more acute social menace.

Milton George, the man who owned those three hundred acres at Glenwood, Ill., was keenly alive to the existence of what today we call the "boy problem." And that was twenty years ago. He loved boys,

The "Cottage Mother" and One of Her Boys

and, while he was not a man of great wealth, he determined that what he had should be given in an attempt to save some of them. Milton George believed there were no bad boys. He believed every single one was worth saving. Six thousand have gone forth from the Glenwood school, founded in a great measure by his munificence, and although he gave but three hundred acres of land to found this haven, he experienced more satisfaction from his gift than if he had planted a thousand libraries.

Up to the time he was forty years of age Milton George followed his vocation of farming. Then, in 1871, he engaged in editorial work on an agricultural journal and continued as its editor and publisher for 25 years. He died but a few months ago. He first offered the land to the city of Chicago if the city would do its part by raising $300,000 for buildings and endowments. Chicago was very busy making fortunes, and the pathos in the lives of thousands of children was too insignificant to distract attention from the pursuit. Friends urged the man to convert his land into a town site, and join in the chase for gold. But the fate of a few boys meant more to him than money. So he made a second offer. He would donate the land if Chicago would raise $100,000. Chicago did not hear him, and it was not until he lowered the amount to $40,000 and succeeded in interesting a number of other philanthropically inclined men and women that the work was started. Then Mr. George devoted the remainder of his life to it. His wife, who was as deeply interested, and who survives him, also made many sacrifices to aid it. In fact this childless couple, who nevertheless had in their hearts a boundless love for children, gave their all to the cause which they deemed paramount.

Clancy Hall, the Chapel

The Illinois Manual Training School Farm at Glenwood is the result. It is an institution unique in its accomplishments, its aims, and its methods. Today 350 boys of from seven to sixteen years of age are there living a healthy, normal life, surrounded with every influence that makes for good moral and physical development.

At Glenwood every boy looks you in the face. If you were not otherwise informed you would imagine yourself at a regular boarding-school maintained by liberal tuition fees from well-to-do parents. Every boy is taught to believe in himself, to respect himself as well as those with whom he comes in contact. There is no physical restraint, no oppressive atmosphere of charity. There are no "inmates" there. There are students. It is not a "home" as that word is applied to some institutions. It is a school. And there is little or no punishment, for there is rarely any wrongdoing. It is hard to imagine 350 boys behaving themselves in such a manner that punishment is not meted out to some of them. Yet at Glenwood this ideal state of affairs has been brought about.

A group of buildings, dormitories, administration offices, etc., form the basis of the average institution. Not so at Glenwood. While there are cottages, administration buildings, schools and shops, back of everything is the Glenwood idea. This idea is that, given clean, homelike surroundings and proper guidance, a boy would rather do right than wrong. In the abstract the idea sounds familiar, but the manner in which that idea is carried into effect is responsible for the magnificent results.

No one who does wrong is a hero at Glenwood. The lad who defies his instructor is not placed on a pedestal and worshipped. Far from it. One boy tried this and that evening his mates held him to account for detracting from the standing of their cottage. They even took him out to a secluded spot and gave him a drubbing which made him feel like anything but a hero.

Everything worth having must be gotten through merit, and, remarkable as it may seem, every boy is made to feel confidence in his own ability.

Helping the Matron Darn the Stockings

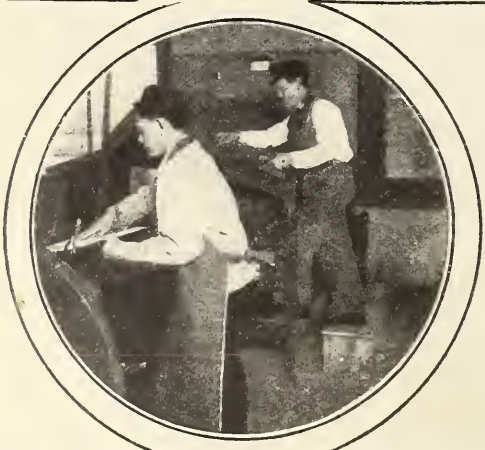
"I am as good as any other boy, and I am going to be a good man," is the feeling inspired in them. A teacher or instructor at Glenwood would not think of telling a boy that he was stupid or bad.

During a visit to the school I went through the cottages where the boys live amid such home-like surroundings. The "cottage mother," or matron takes great pride in the thirty or more young-

Settee of Glenwood Design

Assembling an Engine

Glenwood Boys Making Bread in Bakery



Learning the Printers' Art

sters under her charge. In the pleasant living-room of one of them, which was more tastefully furnished and decorated than the average home, a little shaver of nine was sitting at the table, his head upon his arms.

"Is he sick?" I asked.

"Oh, no, Frank is not sick," answered the cottage mother in a tone loud enough for the boy to hear. "Frank is thinking. He's a good boy, one of the best boys I have, but he forgot. He is just thinking for five minutes about what he did. We were painting the beds today and Frank scratched his name with a pin in the fresh paint on his. Yes, Frank is a fine boy."

A few minutes later he was out flying a kite.

That's the way the little fellows are handled there. It would be well if many boys were treated in the same manner at their homes.

The cottage life at Glenwood is one of its most attractive features. The cottages are not built along lines which would suggest dormitories. They look more like large individual homes, each one different in appearance. The last one erected was the Farm Cottage. It is like a large bungalow, and the interior arrangement and furnishings delight the eye. There is a large living-room with a huge brick fireplace, book-cases along the walls, several fine rugs, and comfortable chairs. The matron has a suite of two rooms, and upstairs are large, well-lighted, well-ventilated rooms in which the boys sleep. Each has his little white cot, covered with spotless linen and a bedspread. Each boy has a little closet for his clothes, and in the basement he has a locker and a box for his playthings. These little fellows take great pride in these boxes, and vie with each other in keeping their belongings neat and orderly. I was permitted to peep into some of them, and a few minutes later noticed a little

fellow making a frantic effort to put his in order lest some one should see in it a chaos of kite strings, shoes, marbles, magazines and a hundred things dear to a boy's heart.

The manner in which a feeling of self-confidence is instilled into the men of tomorrow who are fortunate enough to live at Glenwood was well illustrated by a handsome little fellow of seven, the youngest boy at the school. A baseball game was going on behind the administration building, when Mr. V. P. Randall, the military instructor, was crossing the field. Up to him marched the little boy.

"Mr. Randall," he said, "they say I'm not big enough to play ball. I think I can play, don't you?"

He was assured that with practice he would undoubtedly make a good player, and he trotted away determined to show his larger comrades that he could.

That little incident was typical.

In the manual training classes and in the schoolrooms this same spirit is manifest. The boys are led to believe in themselves, and they accomplish results.

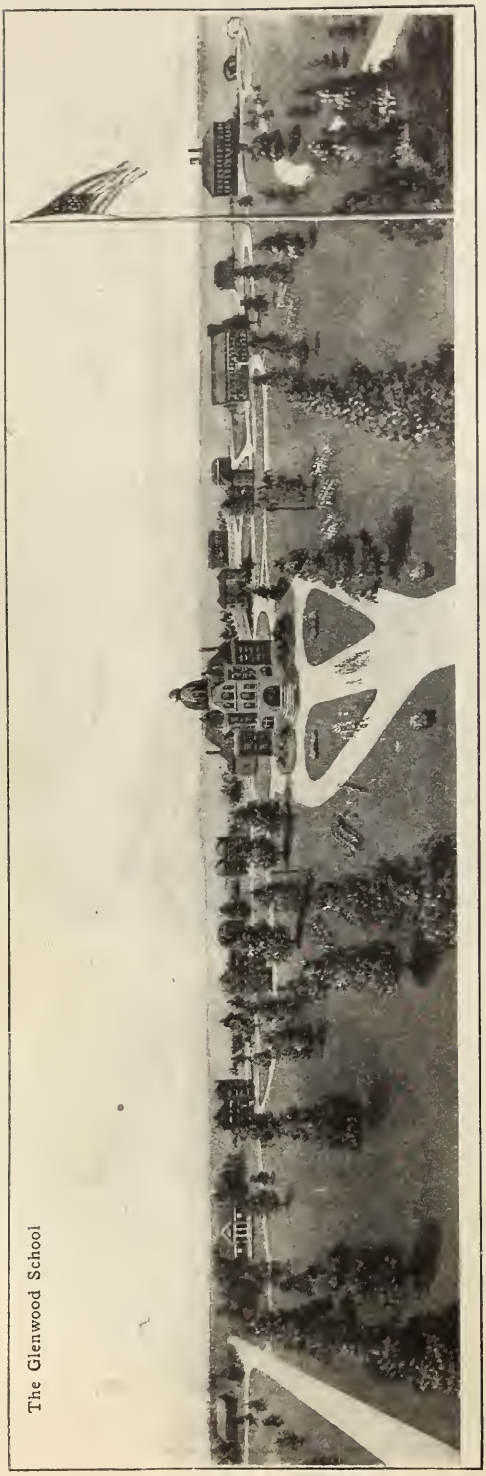
Three hours a day are devoted to the school work, and an equal number to manual training. When a boy leaves Glenwood he has acquired a good grammar school education and a good start in a useful trade. The manual training building is considered one of the best equipped in the country.

There are seven departments: machine, forge, cabinet and wood-working, printing, shoemaking, laundry and bakery. Great care is taken that the instructors are not only skilled in their lines, but capable teachers as well, and men of good moral character. Under the direction of the instructors all the repairs in machinery, iron work, carpentry, plumbing and steam-fitting are made by the boys, so that while they are learning the trades they are assist-

Youthful Wood-Workers

View in the Machine Shop

A Corner of the Laundry



The Glenwood School

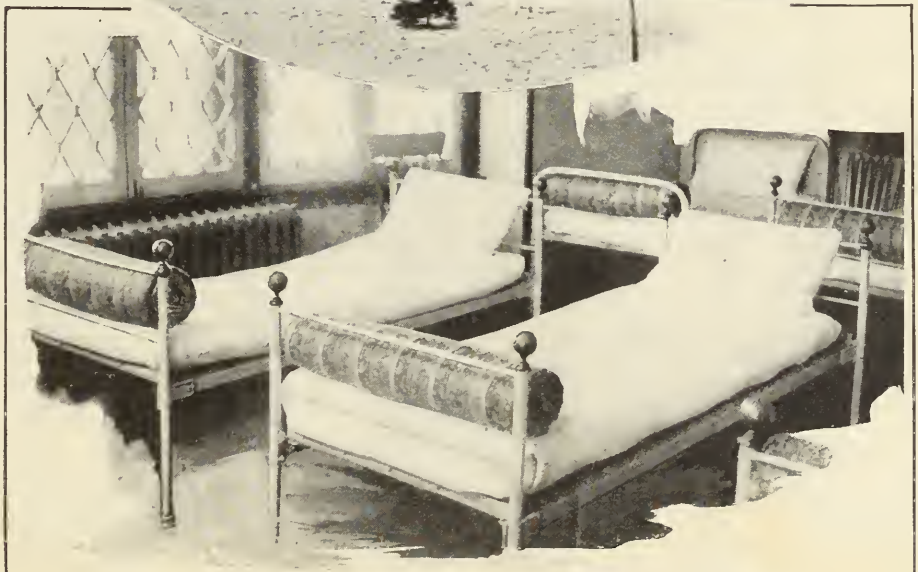
ing in cutting down the school expenses. Some truly remarkable work has been produced by the lads in the wood-working department, some of the original furniture designs being of a high standard.

Monotony is not allowed to creep into the daily study and work. Military drills are made enjoyable, and to rank as an officer is a prize which every boy seeks to secure. Honor medals are given to those who have perfect records, and they have rarely been forfeited once they have been earned. Every boy's record in school work, manual training, military drill, cottage deportment and general deportment is kept by a careful system. Sickness is practically unknown, for the combination of good air and carefully prepared food with plenty of recreation keeps the boys in perfect condition. The subject of sickness is never mentioned in the presence of the boys, and this may, in a measure, be responsible for the prevailing good health. They never think of bodily ills.

Frequent entertainments, such as lectures at the chapel and little parties at the home of Superintendent Leo A. Phillips, also rout any possibility of monotony. Almost every week some interesting lecturer takes the ruddy-faced youngsters to some foreign country with stereopticon and description, and they look forward eagerly to these treats. They are brought to appreciate wholesome, rational amusements, and it is safe to say that after spending a short time at Glenwood the boy goes forth into the world with a fine sense of discrimination between the good and the bad.

One hundred acres of land are devoted principally to the raising of vegetables for the table and fodder for the horses and cattle, and here, under the direction of a trained farmer, some of the boys put in their share of the work. An orchard, a berry patch and a vineyard contribute to the food supply, and milk is supplied by a herd of cows.

When summertime approaches there is a keen rivalry for the privilege of



Spending the Evening in the Living Room—Sunnyside, a Typical Cottage—A Corner in One of the Bedrooms

serving as caddies on the links of nearby clubs. One summer the boys erected a fine greenhouse with the funds they earned in this manner. They are permitted to use the money they earn for themselves, but they preferred to do something for their school.

So quietly has this good work been going on at Glenwood that even Chicago is not fully aware of its significance. No loud-voiced demands are made upon the public purse. The judges in the different courts are familiar with it, and often send charges there when they wish to insure the child's future. The city pays a nominal sum for those it sends to the school, and parents often place their children there when circumstances do not permit their remaining at home. The Commercial Club of Chicago has, through its president, Mr. Edward B. Butler, taken a great interest in this school and has been the donor of a handsome school building and other necessities. Mr. Butler is also president of the board of directors of the school, and, although the head of one of the largest mercantile houses in the country, always finds time to take an active part in the management.

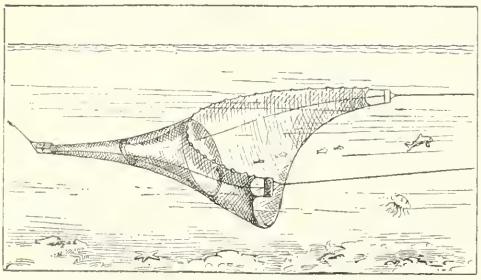
After all, any institution is best known by the results which it has accomplished. Every now and then a former Glenwood boy returns to visit the school, and letters are frequently received which show that the good work started on Milton George's three hundred acres is producing crops whose value cannot be estimated in gold.

HUNTING SEA SPECIMENS WITH NETS

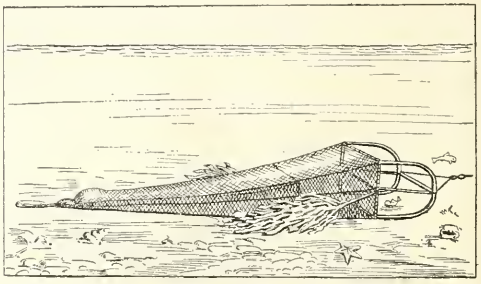
The principality of Monaco is of course, chiefly famed as a pleasure and gambling resort, but the Prince of Monaco is famed for many things, among them being his sportsmanship, enthusiasm for the development of aerial craft, motorboating on a large scale, and his studies of the science of the sea.

The last named is his special hobby, and his yacht, the "Princess Alice," is well equipped for gathering specimens of the sea. The illustrations show three of the many nets he uses in gathering specimens. One is adapted to be hauled along above the sea bottom, another is dragged along the bottom, and the third is a remarkable triangular net. The tassel attached to the net which is dragged along the bottom catches animalculae.

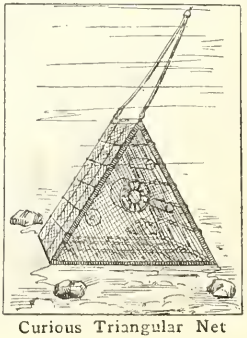
An oceanographical museum, founded by the prince, was recently opened at Monaco, also.



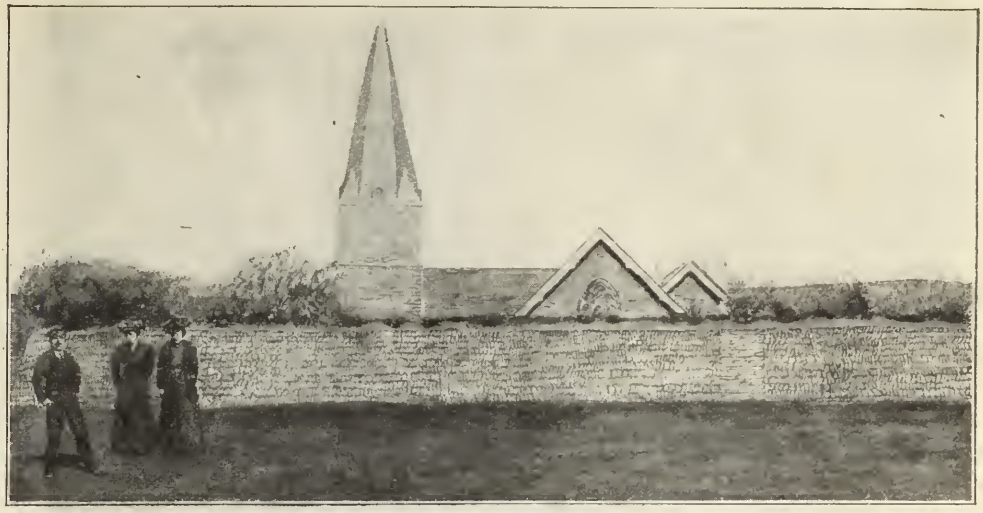
Net Hauled Above Sea Bottom



Net Dragged Along Sea Bottom



Curious Triangular Net



Built About 1200 A. D.

ENGLISH CHURCH BURIED IN SAND FOR CENTURIES

After having been buried for several hundred years in immense sand drifts, St. Edenock's Church, in Cornwall, England, is now being used once more as a place of worship. The edifice was built about 1200 A. D. It is situated near the shore, in a section of the country which is almost devoid of vegetation, great sand drifts covering many square miles. High winds, blowing in from the sea, piled the sand up over the church, completely burying it. No attempt was made to dig it out for several hundred years. A few years ago, however, work was begun, and the ancient church was repaired and services held in it.

EARTH'S SURFACE BOWS ACROSS THE SEAS

Twice each day the buildings upon the seaboards of every country in the world bow to the advancing tide, this movement measuring the yielding of certain sections of the earth's crust under the influence of tidal loads. A few months ago the Bidston observatory, near Liverpool, England, commenced a series of records to determine the exact extent of the movement. According to the Illustrated London News, these records show that, when the tide is high, the ground slopes at that place towards the sea. Twice a day, therefore, the houses in Liverpool bow to the advancing tide, and the buildings on the Irish coast return the salute. The extent and rapidity of the movement depends upon the quickness with which the tide rises to its height.

NAILS AND CEMENT IN EVERY ROLL

A New York manufacturing concern producing various grades of mineral asphalt roofing packs it for shipment to domestic and foreign buyers in a very ingenious way. In the center of each roll of the roofing is packed enough nails for securely fastening it to the roof, and pure asphalt cement for welding and waterproofing all joints and laps. The roofing is composed of two asphalt-saturated wool felts, with waterproofing cement between.

ARTISTIC CONCRETE BUILDINGS—No. 9, Bungalow of W. Bassett Jones, Bryn Mawr, Pa.

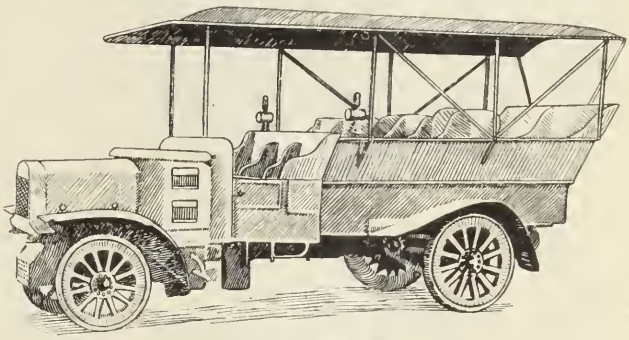
PRODUCER GAS INVADES AUTOMOBILE FIELD

Great strides have been made within the past few years in the development of the producer-gas engine. Its great feature is economy of fuel, and the engine, because of this and its many other good qualities, has now found its way into nearly every industry.

The appearance of a motor car propelled by a producer-gas engine has not been expected for some years to come. The success, therefore, of an automobile fitted with such an engine comes as somewhat of a surprise at this time.

The first producer-gas automobile underwent some pretty severe tests in Scotland recently. As can be seen by the illustration it is of the char-a-bancs type. Its total weight with passengers and a day's fuel supply is over five tons. As a result of the tests made to show its consumption of fuel on a run of 35¼ miles, the engine used 189 lb. of anthracite coal, which at the rate of $4.80 per ton, would mean that the entire fuel cost for the trip would be about 47 cents. Gasoline costs 26 cents per gallon in Scotland, and the same load run over the same course by a gasoline engine, would take about 26 gal. of this fuel, making the total cost $2.86. A comparison of the fuel costs, therefore, shows that the producer-gas engine operated at one-eighth the cost of a gasoline engine under the same conditions.

Nothing distinguishes the appearance of the producer-gas automobile from the ordinary type except the case between the bonnet and the dashboard, which is in no way disfiguring. This case contains the producer with sufficient anthracite for a 10-hour run. At the bottom of the case is the door for lighting up the producer, and above this is the hopper, the lid being lifted for filling. Air is forced through the bottom of the producer by a blower, and as the gas rises to the top of the hopper, it is strained and led through a pipe to the cleaner at the back of the car. From here it goes to a suction-box where it is mixed with air, and thence to a four-cylinder engine working with a compression of 115 lb. The water is fed to the producer by a specially designed pump, which is controlled by the same wire that actuates the throttle, so that the gas is kept at a uniform quality at all speeds.



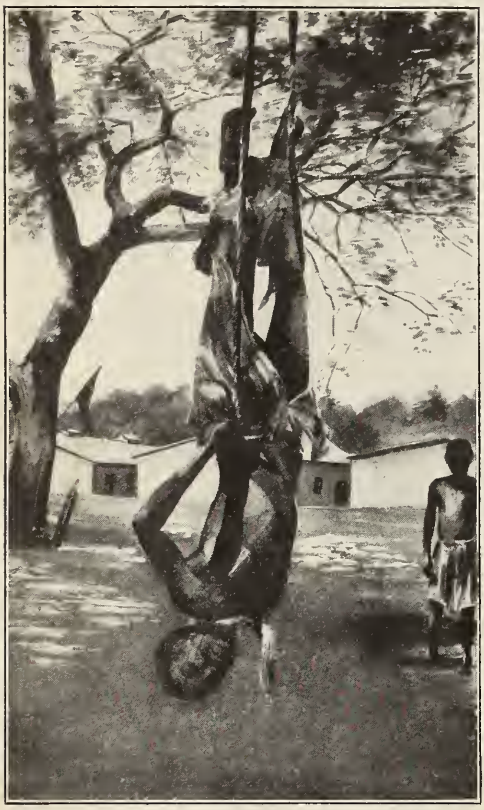
The First Producer-Gas Motor Car

One point observed during the trials was that the exhaust was entirely free from smell and quite invisible. If this can be relied upon in ordinary working it would remove one of the chief objections to producer gas for motor vehicles, since it implies that there is no carbonizing of the valves or cylinder walls, which would cause irregular working and necessitate frequent cleaning.

¶A wireless telegraph station near Berlin claims to have succeeded in maintaining wireless communication with a steamship during the entire voyage from Hamburg to Cameroon, Africa, the greatest distance signalled being 4,000 miles. The messages had to pass over the Alps, the Algerian tableland, and the Adamana range. This would establish a new record in combined overland and ocean transmission of wireless messages.

HANGS HEAD DOWNWARD EVERY DAY FOR THREE YEARS

In a small village outside Bombay, India, is a fakir who spends all the



Hanging Head Downward as a Daily Occupation

hours of daylight of every day suspended head downward with his head about two feet from the ground. Two fiber ropes, attached to the limb of a tree, constitute his support. Early every morning he takes hold of the handles at the ends of the two ropes, reverses the natural position of the body, and hangs in such position until sunset.

He has been doing this now for more than three years.

¶"Deadly Weapons" is the flaring sign over the window at the license bureau of the Chicago city hall, where automobile owners apply for permits to run machines.

SPEEDOMETERS FOR SHIPS

A speed indicator which does the same service for a ship as the speedometer does for an automobile or motorcycle is now available for large vessels, such as warships, passenger liners, and large steam yachts. But the apparatus, in its present form, is not practical for small craft of the motorboat type, because of its prohibitive cost, which exceeds $500. The demand for an adequate speed recorder for small boats is rapidly growing, however, and will probably be filled before long.

The apparatus furnished by an English company for large ships is a combined distance recorder and speed indicator. It consists of a tube running through a sea-cock projecting below the bottom of the vessel, preferably at a point about one-third of the vessel's length from the bow. In the lower portion of this tube, facing downward, and in the upper portion, facing aft, are openings through which the water passes as the ship moves. The water enters through the lower opening, passes through the tube, and emerges from the upper opening. In the tube is a small propeller, carried on a shaft which runs up through the tube into the ship.

Three guide rods are attached to the casting which forms the body of the sea-cock, and by the aid of these the tube can be drawn up into the ship without the adjustment being altered, and when the sea-cock is closed it can be taken away for cleaning or examination. At the top of the tube are two distinct pieces of mechanism. One of these is a small magneto generator, driven through gearing by the propeller in the tube, and its purpose is to supply electric current for working the speed indicator. The voltage of the current generated is in proportion to the speed of the propeller in the tube, which in turn is in proportion to the speed of the ship. By leading this current to a voltmeter, which has the scale marked off in knots, an accurate indication of the speed of the ship is obtained.

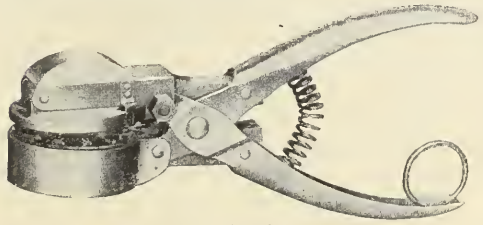
The second piece of mechanism at the top of the tube is a commutator. From this, connections are taken to the distance-recording dial, and, as the number of contacts made in the commutator depends upon the number of revolutions of the propeller, the indications are a true measure of the real distance traveled by the ship. Contact is made 100 times while the ship travels one mile.

Owing to the fact that the apparatus works electrically, it is possible to have a number of dials distributed over the ship for the benefit of passengers as well as for the officers.

AUTOMATIC TIME PUNCH FOR STREET-CAR TRANSFERS

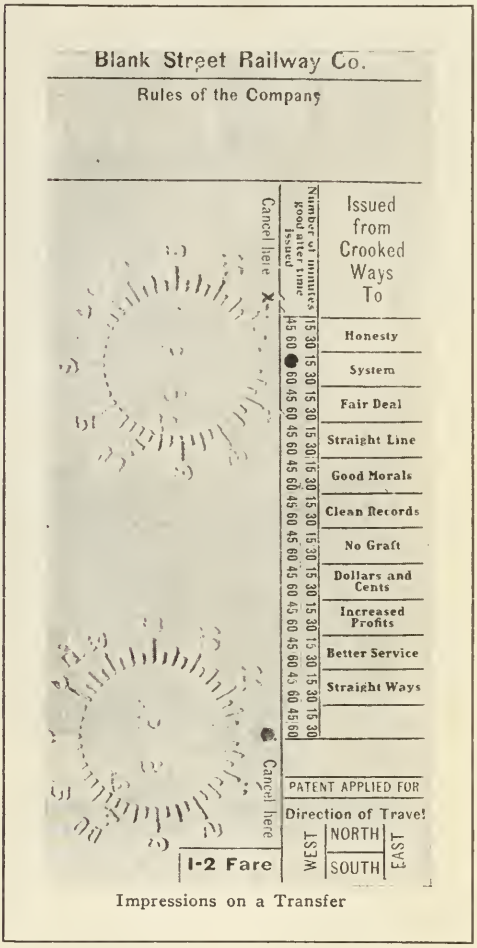
A conductor's punch provided with a clock mechanism that automatically impresses the time on a transfer has been placed on the market to take the place of the ordinary punches used by street railway conductors. One punch with the new device indicates upon the transfer the month, date, time of day, number of punch, and destination of passenger, while the conductor provided with an ordinary punch has often to use it five times to get the same result.

The punch also places upon the transfer the time beyond that of actual issue within which the transfer may be used by the passenger. This time limit being automatically placed upon the transfer enables the receiving conductor to see at a glance whether it is



The Automatic Time Punch

being used within this limit or not. The punch contains a reliable time mechanism and dating wheels so arranged that they can be easily changed at the office from day to day. The indications made by the punch cannot be changed except by an authorized person, as the operating mechanism is sealed after being wound for the day.



Impressions on a Transfer

The same punch is used by the receiving conductor in canceling the transfer. One of the illustrations shows a transfer punched twice, once by the conductor giving out the transfer, and once by the conductor receiving it.

¶The East is making great progress in aviation. Ceylon is to have exhibition flights by Sands, a pupil of Latham, a Punjabi has invented a successful biplane, and Bangkok is planning an aviation meeting.

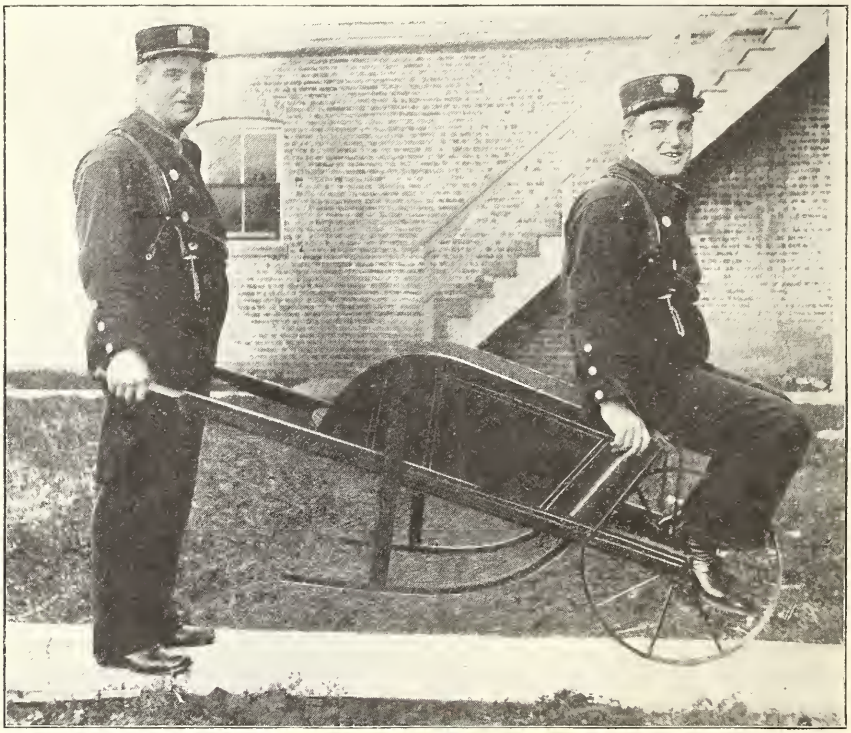
VACUUM-CLEANING STREET CAR REMOVES DIRT FROM RAILS

The vacuum cleaning principle, which is rapidly extending its scope of usefulness from the cleaning of vehicles and building interiors to such tasks as cleaning streets, has been adopted by the street railway of Hanover for the purpose of removing dirt from the grooves in its tracks.

When streets are cleaned by brushes the dirt is pushed into the grooves of the rails and is hardened into a compact mass by the weight of the passing cars. The rails become so coated with dirt as to offer resistance to the electric current, and it is to remedy this that a special car has been provided with a vacuum-cleaning system.

Between the front and rear wheels on both sides of the car are steel brushes, which loosen the dirt from the rails. Working in connection with the brushes are tubes which draw the loosened dirt into pipes that deposit it in a dirt receptacle. The pump providing the air suction is driven by an electric motor attached to the dirt box.

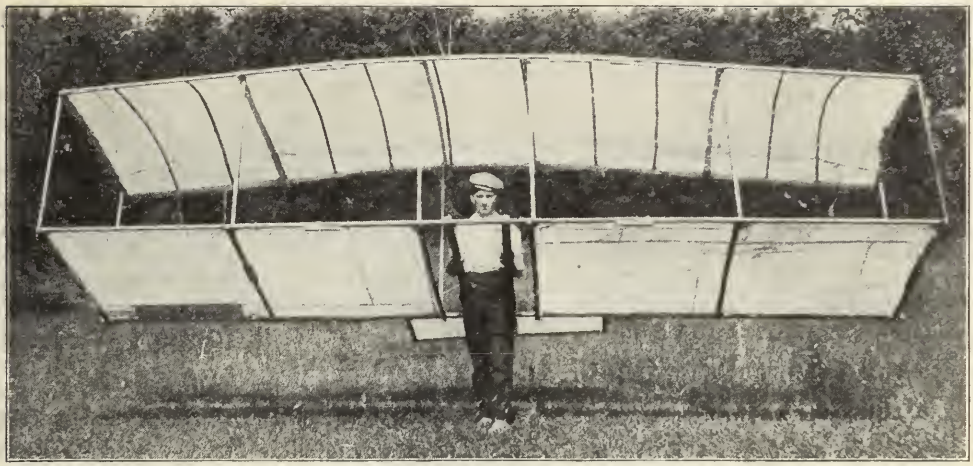
The car cleans an average of 45 miles of track a day, is operated by one man, and will work with good results at any speed not exceeding 18 miles an hour.



A Successful Duplicate Photograph

WHAT OUR READERS ARE DOING

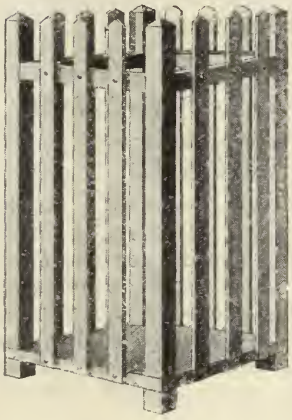
The accompanying half-tone engravings are reproductions from two of the many original photographs we receive illustrating articles made from the descriptions given in the Shop Notes and Amateur Mechanics departments of Popular Mechanics. In one of our recent numbers there was given a complete description and dimensioned drawing of a glider. One of the many gliders made from this description is shown in one of the illustrations, and is the work of N. Chadwick, Philadelphia, Pa. The half-tone picture show-



Successfully Made According to Our Instructions

ing a person wheeling himself was reproduced from a photograph made by G. E. Sandman, Chicago, Ill., who used a duplicator on his camera, made from our description.

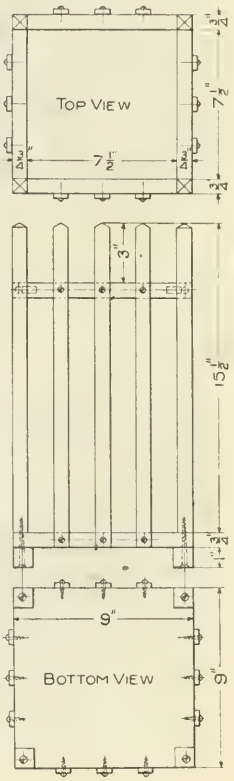
A WASTE PAPER BASKET



A waste paper basket of pleasing design, and very easy to construct, is shown in the accompanying sketch. Quarter-sawed oak is the best wood to use, and it is also the easiest to obtain. The following pieces will be needed:

1 bottom piece, ¾ by 9 in. square.
4 corner pieces, ¾ in. square by 15½ in.
4 top rails, ¾ in. square by 7½ in.
12 slats, ¼ by ¾ by 16¼ in.
4 blocks, 1 in. square.
4 F.H. screws, 2½ in. long.
24 R.H. screws, ¾ in. long.

If the pieces are ordered from the mill cut to length, squared and sanded, much labor will be saved. First bevel the ends of the corner posts and the slats, as shown, and finish them with sandpaper. Bore the holes in the posts and the railing for the dowel pins. These pins should be about ⅜ in. in diameter and ¾ in. long. When this is done the parts can be glued together and laid aside to dry. The four blocks 1 in. square are for the feet. Bore holes through these blocks and the corners of the bottom board for the large screws to go through. Fasten them together by running the screws through the blocks, and the board into the ends of the corner posts as shown in the sketch. The ¼-in. slats can now be fastened on with the small round-headed screws. They should be evenly spaced on the four sides. This completes the basket except for the



finish. This can be any one of the many finishes supplied by the trade for this purpose.

MECHANICAL ELEPHANT IMPRESSES AFRICANS

A British expedition to the Kasai basin in the Congo Free State received

Toy Elephant Which Served British Expedition

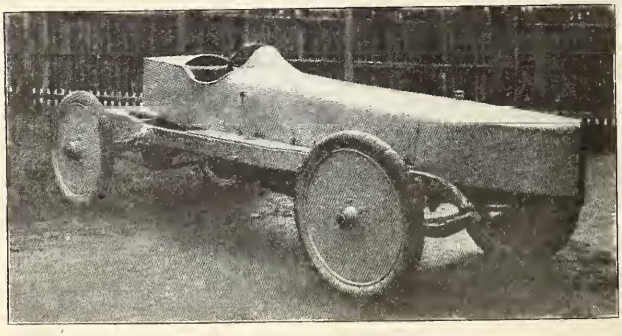
much consideration and aid from natives that otherwise would have been more or less unfriendly through the simple means of a toy clockwork elephant. The toy, with trunk extended upward, stood only 10 in. high, but its movable trunk and legs inspired the natives with considerable fear.

INCREASE IN UNITED STATES BATTLESHIP BREADTH

The remarkable increase in the breadth of American warships since 1903 is shown by the following figures: Between the authorization of the "Texas" in 1886 and the "South Carolina" in 1905 the average increase of beam was about 9 3-5 in. annually. For the period of 21 years between the "Texas" and the "Delaware," authorized in 1906, the total increase in beam was 22 ft. 1½ in., an average of approximately one foot a year. Since the authorization of the "Michigan" in 1905 the rate of increase has been nearly trebled.

The "Arkansas" and "Wyoming," the 26,000-ton monsters authorized in 1909, will have a breadth on the load waterline of 93 ft. 2½ in.; the "Florida" and "Utah," authorized in 1908, are 88 ft. 2½ in.; the "Delaware" and "North Dakota," authorized in 1906 and 1907, 85 ft. 2½ in.; the "South Carolina" and "Michigan," authorized 1905, 80 ft. 2½ in.; and the "Idaho" and "Mississippi," authorized in 1903, 77 ft.

AUTO OF 20 HORSEPOWER MAKES 88-MILE-AN-HOUR SPEED



A 20-Hp. Flyer

High-powered, heavy racing automobiles have made speeds, for short periods, of over 100 miles an hour, and one car, equipped with a 200-hp. engine, has attained a speed, for a minute or so, of 132 miles an hour. But the car shown in this illustration has made a speed of 88 miles an hour on but 20 hp. It is provided with a special wind resisting body, and its speed is the greatest ever attained with such small power.

¶A minister of Lima, Ohio, advertises his Sunday sermons in moving picture theaters.

HEALING LUPUS WITH ELECTRIC LIGHT

A few years ago Queen Alexandra of England introduced from Denmark the Finsen treatment for lupus into the London Hospital, presenting the first lamp. The installation is now the finest in the British kingdom. The light is supplied by a powerful arc, the rays passing through telescopes, parts of which are filled with water to absorb the heat. The skin of the patient

Lupus Room of London Hospital

is first made bloodless by pressure, and then a spot of light about the size of a penny is allowed to fall on the afflicted part for an hour, after which a cooling ointment is applied. Twelve lamps, with a nurse at each, are in use, and about 70 patients are treated for an hour each day. The treatment is painless, and the cure takes from three to 18 months, according to the severity of the disease.

Lupus is a disease of the skin occurring in two distinct forms. One form is characterized by an eruption of red patches, which become incrusted, leaving superficial scars. The other is marked by the development of lumps, which often ulcerate deeply and cause great deformity. Formerly it was often confounded with cancer, and some varieties of cancer were included under lupus.

The Modern Mechanic

Oh, I'm a professional auto-man,
A driver of daring and skill.
In goggles and cap, I'm a stunning chap,
Gotten up in a style to kill.
I know all the merits of each machine
In every particular part;
There isn't a thing from a spoke to a spring
That I haven't got down by heart.

In friction, ignition, combustion and power,
In sprockets and ratchets and cams,
I'm right up in front and can do every stunt
When the what-yer-may-call-it-em jams.
Rarefaction, velocity, fuel, viscosity,
Cylinders, throttles and pumps,
Are simple to me as A, B and C,
When the thingumbob sputters and jumps.

Of jack and packing, connectors and sectors,
Flanges and bevels and joints,
Of shaft revolution and weight distribution,
I know all the decimal points.
Selective control is dead easy to me,
The battery simply a snap;
The plug of the spark I could see in the dark,
Fix the nozzle while taking a nap.

The mud guards I know from the lamps at a glance,
The tires I can tell from the brakes;
Valves, clinchers and strokes are mechanical jokes;
Ratios, mathematical fakes.
Garages, speedometers, gasoline tanks,
Vibration, displacement and sprays,
Bolts, rivets and chants, co-efficients and strains,
I can talk of in technical phrase.

There's only one thing I am waiting for now,
Ere my knowledge can fully prevail:
If I only could steal an automobile!
I have cribbed all the rest by mail.

—Frederick Maxon in Life.

Exterior of Electric Railway Sleeper

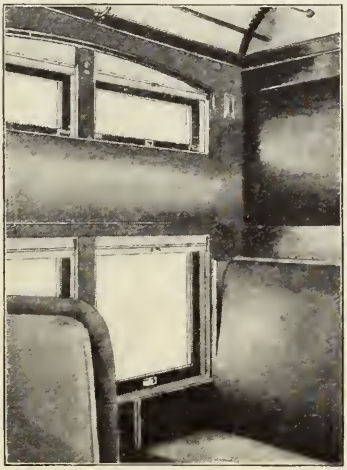
SLEEPING CARS FOR ELECTRIC RAILWAY

An Illinois traction system has placed two exceptionally interesting sleeping cars in service on its line between St. Louis and Peoria, Ill., a run of 172 miles. The cars are not provided with motors, but will be used as trailers behind an ordinary service car, thus doing away with much of the noise.

Probably the most interesting feature of this new design of sleeping car is the window arrangement by which fresh air and an outside view are provided for the upper berths. As shown by the illustrations, two narrow windows are provided for each upper berth. These are just above the ordinary windows of the cars and add much to the appearance of the exterior.

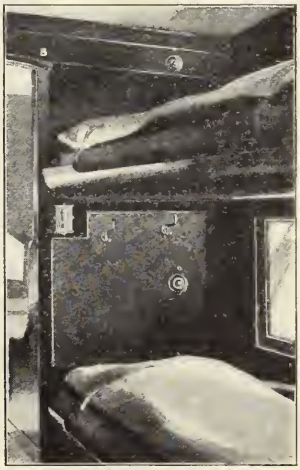
The cars are 54 ft. long. They have 10 upper and 10 lower berths, both upper and lower being 37 in. wide, and at one end is a smoking room and toilet facilities for men, while the other end provides toilet facilities for women, a heater compartment, and linen lockers.

The arrangement of berths is very ingenious. The two end compartments are provided with seats for daytime use that form berths at night. In forming the berths, the seat cushions slide together in conjunction with two auxiliary cushions stored during the



An End Berth Section

Middle Section with Berths Folded



Berths of Middle Section Lowered

day, and provide a lower berth with deep springs, while the seat backs, hinged at the top, swing upward to form the upper berths. These sections have an appearance similar to Pullman car sections, but the three compartments on each side in the middle of the car are of a new design, as it is not intended that the passengers shall be seated in them except just before retiring and after rising. These berths, both lower and upper, are hinged to the framing of the car and their weight is so balanced that they may be folded up against the windows. Each berth is removable, a feature that makes it possible to carry them outside the car for thorough cleaning and airing. The occupant of one of the lower sections may push the berth up against the window before retiring or on rising and thus have the entire floor space and room under the upper berth for disrobing or dressing.

A colored porter attends the passengers on the car, and serves them with a light breakfast of hot coffee and rolls from a portable fireless cooker.

THE ARGUMENT AGAINST A SANE FOURTH

[The following is from a well known company engaged in the manufacture of firearms.—Editor.]

"Editor: I read in your May issue an article against fireworks, firearms and blank cartridges on the Fourth of July.

"This of course is not liable to help us and I enclose herewith an article giving a few points on the other side."

So many articles in favor of a noiseless Fourth of July, have been published lately, that perhaps the other side may interest the public.

In the first place it is a boys' day; the greatest celebration day in the year for the American Boy, and to him, celebration means enthusiasm and noise. These are his means of showing patriotism. He cannot understand the orators' words picturing the signing of our independence and thus the significance of the greatest American anniversary is lost to him.

Do we want our future men to lose sight of the significance of this big day? Generation after generation has celebrated with noise and enthusiasm, awakening the patriotism of our youth; do we want this enthusiasm dulled?

The following extract from an article written last year by Police Commissioner O'Meara of Boston, throws a different light on the subject. He says: "The Fourth is a day to celebrate. I believe in celebrating. If I didn't, I wouldn't be a thorough American, and I don't think that the celebration should be confined to pink lemonade and peanuts. It is an occasion to warm up and let the world know that you are alive. If we didn't want to shoot off firecrackers and fireworks we wouldn't be human. This doesn't mean to try to kill our neighbors or ourselves. We don't have to make the Fourth of July a day of slaughter. We are sensible enough to know this. If you go too far, we will have to stop you. The day is yours. Have your noise, your excitement, your firecrackers. We won't interfere as long as you remember that you are law-abiding Americans."

Another point in favor of the "real" American Fourth is self-protection. We must depend on our young men in case of war because our standing army is so small. If we bring up our boys in the fear of gunpowder they cannot be so efficient, if they are needed in the field later.

Let the father instruct his sons how to handle fireworks and firearms and the accidents will be stopped. Let the American boy vent his enthusiasm on the Fourth and stamp the significance of this great day on his mind.

E. M. Benson.

¶The latest torpedo boat destroyer of the United States navy, the "Reid," recently attained a speed of 36 miles an hour.

GLASS BRICKS AS BUILDING MATERIAL

Glass bricks are attaining such a wide popularity in Europe as a material for interior wall construction that the dealers in junk find a ready market for such refuse glass as old window panes, broken bottles, and the like. This glass, gathered from the refuse heaps, is melted and run into molds. The bricks thus formed present a smooth impervious surface.

The glass bricks are being used in schools, stations, hospitals, theaters, public buildings, railroad stations, and even in meat markets. Many of the meat markets in Hamburg are made to convey an impression of dazzling purity by their use. Several schools and hospitals in Milan have adopted the bricks because they reflect more light than ordinary wall material, while in Dresden and other cities of Saxony they are used in theaters and public buildings.

¶The Pennsylvania railroad is experimenting with wireless telegraphy to determine its efficiency for railroad work.

SOUTH AMERICA'S ORCHID TRADE

Orchids, admired so greatly in American and European greenhouses, are exported from the Central and South American countries, where they are found at the edges of forests, along the banks of streams, and on mountain sides. Most of the species sought are air plants, found attached to the limbs or trunks of trees in light and airy positions, rarely in dense shade. They do not take nourishment from the tree which serves to support them, but from the atmosphere through the roots spreading over the surface of the bark.

Transporting Orchids Down South American River

The most beautiful and unrivaled of all orchids is the Cottleya, which rarely grows at a lesser height than 2,000 ft. above sea level and seldom above 4,500 ft. Other beautiful kinds grow at heights ranging from 4,000 to 10,000 ft.

In collecting the orchids, parties go out into the forests carrying food for a week, shotguns, stringbags, and the knife known as the "machete." After the camp site is selected and the camp erected, the party, according to an article in the Guide to Nature, goes out during the day looking for the par-

ticular kind of orchid wanted. When they are found, the trees supporting them are, as a rule, cut down, and the plants stripped from the trunks and

An Orchid from Colombia

branches and placed in the stringbags. When a number have been gathered the men carry them on their backs to the village, where a house of some kind is secured in which to store them. Several trips are made before a sufficient quantity is procured, then they are packed in dry shavings in well ventilated boxes, made for the purpose from logs sawed into boards by hand, loaded onto mules or oxen, and transported to the nearest river.

Sometimes the journey to a river takes several days, or weeks. Once at the river the boxes are loaded on specially built rafts and floated down the stream until a place is reached from which transportation by steamer can be obtained to the coast. The coast being reached, the boxes are transferred to ocean steamers bound for the United States or Europe.

If the plants are received in good condition they will, under proper culture, produce their beautiful flowers within a year, or even less, from the time they were taken from their native forests.

INCH AND MILLIMETER CAUSE AUTO TROUBLE

The fact that several parts of American automobiles are measured in millimeters, one of the denominations in the metric system, instead of in English inches or fractions of inches, is causing so much trouble that many manufacturers are demanding a solution. They either want the metric system adopted wholly, or done away with altogether, instead of the present mixed condition of affairs. But to adopt the metric system requires that millimeters and meters must be taught instead of feet and inches, and America, it is believed, is hardly ready for such a sweeping change.

"The American car today," says Motor Age, "is, in many cases, a mixed proposition, a hybrid as many would express it. The bore and stroke of the cylinders are in inches, the diameter of the bolts is generally in inches, the tire sizes are in inches, but several parts are used which are made in metric sizes. Spark plugs of metric diameter and metric threads are used, which means that the car manufacturer must drill his cylinder castings to take these metric sizes. Also, he must fit the necessary amount of metric machinery in order to accommodate the metric products made in Europe, which he fits on his car. Some American cars are more metric than others, some of the bolts as well as the spark plugs being metric sizes."

A meter is 39.37 in., or about 3¼ ft. A millimeter is .03937 in., or, roughly speaking, 1/25 of an inch. Instead of saying the cylinder of a car has a 5-in. bore and 5-in. stroke, the European expresses it 127-millimeter bore and stroke.

¶China is to establish an arsenal to manufacture its own ordnance.

HEAT

Part VI—How Heat Travels

By J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the sixth article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. In the February number "The Nature of Heat and How It Is Measured" was discussed; the March article told "How Low Temperatures Are Produced;" in the April number "Some Effects of Low Temperature Upon Matter," were described, the May number treated of "The Production and Uses of High Temperature," and in the June issue "High Temperatures and the Rare Metals" was discussed. Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

THE fact that heat does travel is familiar to everyone. Whether it is demonstrated to us in a forcible manner as when we attempt to stir a fire with a poker that has been allowed to remain a few minutes in the red hot coals, or whether it is through the warming influence of the sun, millions of miles away, we know that somehow or other, heat energy has the power of traveling from place to place. Sharp-eyed, deft-handed experimenters have not only established this truth in a scientific manner, but they have also added many interesting and valuable facts to the world's store-house of knowledge. It is the purpose of this article to make clear some of these phenomena of heat which are met with daily, but are not commonly understood.

Ordinarily speaking, heat travels in three different ways: conduction, as in the case of the poker above mentioned; radiation, as when it travels from the sun to the earth; and convection, which will be explained later.

As has been shown in a previous article, heat is simply a form of vibratory energy. The tiny molecules, which make up matter are never at rest, but are forever swaying backwards and forwards, up and down, in every conceivable direction. If this motion be increased and the molecules move through wider arcs, we say that the body has become hotter. If the motion could be absolutely stilled, then the temperature of the body would be zero—absolute zero—460° below the Fahrenheit zero. Heat is the lowest form of energy, *and eventually all matter in the universe will have precisely the same temperature.*

If this fact be true, it implies that heat must travel—not only from molecule to molecule, but from mass to mass, from earth to earth, and from sun to sun. Space is the clearing house of the universe for energy, and its emissaries and agents have been busily engaged in squaring accounts from the beginning of time, and will continue their almost endless transformations for eternities yet to come.

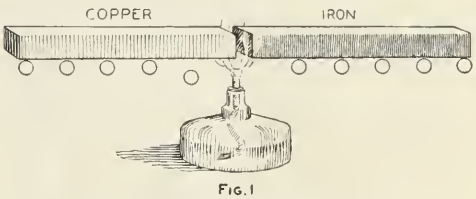


FIG. 1
Spirit Heat Lamp and Bars of Copper and Iron

Conduction, the transfer of heat from molecule to molecule, is possibly the most readily understood of the three modes of travel. A molecule is made to sway in a wider arc. This increased motion is passed along to the next molecule, and then to the next, and so on until all are swaying harmoniously.

Some molecules, however, take kindlier to an increase in their velocity than others. In Fig. 1 are shown a bar of copper and a bar of iron, with little metal balls attached to them by wax at equal intervals from where the spirit lamp heats the junction of the two elements. The balls will drop from the copper bar faster than they will from the iron. We are therefore justified in stating that copper is a better conductor than iron, although just why the copper molecule takes up the energy of motion more readily than the iron, we do not know. It is on a par with many other curious facts in nature, the reason for which is unknown, and we are

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prone to pass it over with the familiar remark, "it is the nature of the thing."

Silver and German silver furnish us with a still more striking example of this variation in the conductivity of metals. Heat will pass through silver

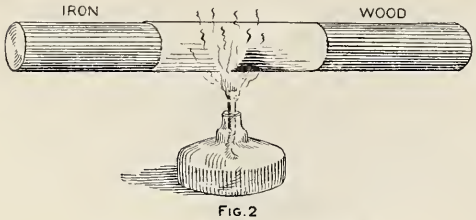


FIG. 2
Experiment in Heat Transmission

with the least possible resistance, while German silver furnishes an almost impossible barrier to the transfer of heat energy, the relative conductivity being about 14 to 1. Some day, possibly, we shall understand the reason why, and electricity will be the key to the mystery, as it is quite likely that, after all, heat is but a form of electricity, whatever that mysterious fluid or condition is; or else heat and electricity are only forms of some other unknown force. It is as hard for electricity to force its way through German silver, as it is for heat, giving us a very broad hint as to the relationship existing between those two mysterious employes so commonly used in our service.

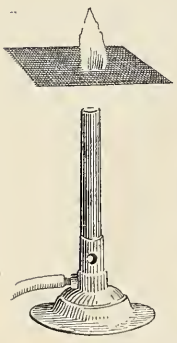


FIG. 3
Experiment

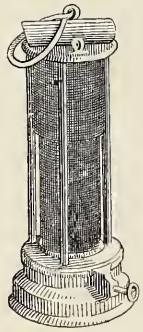


FIG. 4
Davy Safety Lamp

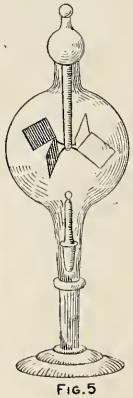


FIG. 5
Radiometer

A very striking experiment (See Fig. 2) illustrating the difference in the power of substances to transmit heat may be shown by heating a paper-covered cylinder one half of which is iron, and the other half wood. The paper on the wood half will char, while the other part over the iron will be unaffected by the heat, as the iron immediately conducts the heat from the paper, while the wood is unable to do so. Water may be boiled in a paper crucible, if care is taken to have the paper smooth and free from wrinkles, as the temperature cannot rise above the boiling point of water, which is not sufficient to burn the paper.

Figures 3 and 4 are illustrations of the practical use to which the high conductivity of iron is put. In order to produce combustion, three things are essential: something to burn, something to support combustion, and a sufficient temperature. The gas above the wire screen is burning, the gas below is not. The reason for this curious state of affairs is simple. The fine mesh of iron wire which forms the screen is really made up of small iron tubes. The burning gas in attempting to pass through these tubes into the unignited gas below, loses some of its temperature by the rapid conduction of heat by the iron; hence one of the conditions for combustion, a sufficient temperature, is lacking, and the gas below will not ignite. If a flame be entirely enclosed in a fine, metallic mesh, a Davy safety lamp (Fig. 4) is the result. It is hardly necessary to call to mind the inestimable value of this simple bit of apparatus, as it has probably saved more lives than any other safety device ever invented by man.

It is an interesting and important fact to mill owners and all others who use boilers, that the scale which accumulates on the interior of boilers is a very poor conductor of heat, and while the scale prevents the loss of heat from the enclosed water and steam, it also prevents to a large extent the access of heat from the fire to the boiler. Soot or grease on a boiler are also antagonistic to the economic use of fuel, and an untidy fireman is an expensive workman. It has been estimated that

one-tenth inch of scale, and one-hundredth inch of soot or grease are the equivalent of ten inches of metal. In other words it is just as easy for heat to pass through ten inches of iron as it is to pass through one-tenth inch of scale or one-hundredth inch of soot.

Metals are by far the best conductors of heat, and silver heads the list. A good conductor always feels colder to the touch than a poor conductor. A good illustration of this is afforded when we step with bare feet from carpet to linoleum. Both substances may have the same temperature, but the linoleum conducts the heat more rapidly from the body, and hence feels colder. Liquids are extremely poor conductors. Water, for example, may be at the boiling temperature at its surface, and at the freezing point a few inches below. Gases are even poorer conductors than liquids. It is exceedingly difficult to prove that dry air has any conducting power at all. This inability of air to conduct heat is a blessing in disguise, as it is largely due to the presence of air between the meshes and fibers of our clothing which enables us to keep warm in winter and cool in summer. The air space between the walls of a refrigerator acts in the same manner, and keeps down the insistent demands of the ice-man.

Radiation seems to be a favorite mode of heat travel, as by far the greatest amount of heat transference is done by this means. To understand what radiation really means we must know something about light. Light and radiant heat are so closely allied that it is difficult sometimes to make a distinction between them. They travel together with the same velocity, about 186,000 miles per second. Both can be reflected and refracted, and both cast "shadows." It might seem strange to speak of heat shadows, but anyone knows that the shady side of a street is cooler than the sunny side, and the buildings which shut off the direct sunlight, do the same for the radiant heat which accompany it. The vibrations of the ether which constitute radiant heat are a little longer than those of light, and are not hot in the sense that they have a temperature comparable to the medium through which they pass. For example the temperature of space is probably close to the absolute zero, and yet practically all the heat on the earth's surface comes from the sun through the intensely cold ether of space, a journey of ninety-three million miles, without heating it in the slightest degree. If it were "hot," it would part with its heat long before it reaches the earth in accord with the well-known fundamental principle that all bodies either give or take heat until they are equalized. Radiant heat might be likened to money. A dollar cannot be used as an article of food, but it can be transformed through the agency of a baker into good, substantial bread. Radiant heat is only a form of energy payable upon demand in what is known as "sensible" heat.

Everyone has seen the apparatus known as a radiometer, Fig. 5. The tiny little vanes whirling around without any visible cause, have always been a source of interest, if not of wonder, to the wayfarers who chance to pass a shop-window where these delicate instruments are displayed. The little globe is almost an absolute vacuum, and the radiant heat readily crosses the vacuum and strikes the little vanes of mica or aluminum. It will be noticed that one side of each vane is black, the other is bright and shining. The radiant energy is absorbed by the black side, and reflected by the other. A "kick" is thus set up by this unequal action, much the same as that which is given to a boat when one jumps from it to the shore. A radiometer has therefore two important uses, and should not be considered a toy. It demonstrates the fact that radiant energy will traverse a vacuum, and is also a good example of the law that action and reaction are equal and opposite in direction. Radiant heat meets with some trouble in passing through glass, and after it has made the journey, as through the windows of a

greenhouse, the longer waves are unable to escape, and hence are put to work by the gardener in raising the temperature of his domain.

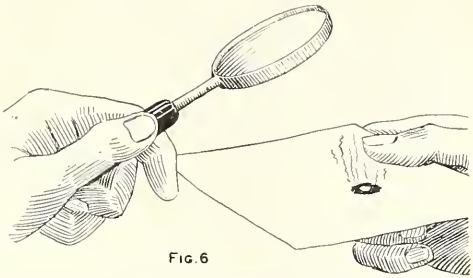


FIG. 6

Charring of Paper by Means of a "Burning Glass"

A "burning glass," Fig. 6, also depends for its efficacy upon the fact that light travels with more difficulty through air than through glass. Figures 7 and 8 show how a triangular bit of glass known as a prism will impede the waves of radiant energy which fall upon it, and while these waves succeed in passing the barrier, their direction is turned. Figure 9 shows two of these

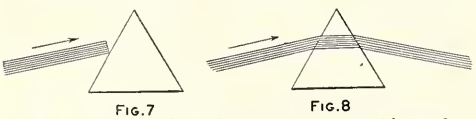


FIG. 7 FIG. 8

Fig. 7—Rays of radiant heat approaching glass prism, which is much denser than air. The first rays entering prism are hindered, while the rays still in air are moving with the original velocity. This produces a bending of the rays.
Fig. 8—Full effect of prism on rays of heat.

prisms placed base to base, and their united action in bringing rays to a focus. A double convex lens is simply two prisms placed base to base. Burning glasses of great magnitude have been made. One made by Bernieres and Trudaine about a century ago was 4 ft. in diameter, and was hollow. When filled with water or other liquid through which radiant heat can pass, it produced heating effects sufficient to melt metals whose fusion point is very high. It is interesting to note in this connection that lenses have been made of ice, and by their use fire was readily procured. Gunpowder and paper were easily ignited by this queer kind of burning glass. Ice is certainly a strange agency through which fire may be produced.

Radiant heat is readily reflected and when mirrors are made of the special curvature known as parabolic, their power is almost unlimited as a means of heat concentration. A parabola is the same curve as is traversed by a stone which is thrown slantingly into the air, and returns to the ground. All rays of energy passing into a mirror shaped like this peculiar curve are reflected to one point called the focus, providing the rays enter the mirror parallel to a line at right angles to the exact center of the mirror. Conversely, rays of light, or heat, or sound, emanating from such a focus, are made parallel after reflection against the sides of the parabola. By combining two such mirrors, so that their axes exactly coincide, as shown in Fig. 10, it is possible to transmit heat quite a distance, and reconcentrate it upon some object. If a lump of ice be placed where the red hot coal is shown in Fig. 10 and a thermometer be substituted for the match, the thermometer will at once show a decided fall in temperature. At first thought, it might appear as though "cold" can be radiated as well as heat. This, however, is not so. "Cold" is simply the absence of heat. All bodies, as has been stated before, tend to equalize as regards temperature. The burning coal gives off heat, so does the match. The coal gives off more than it receives, while the match receives much more than it gives off. Hence the match ignites. When the ice is substituted for the

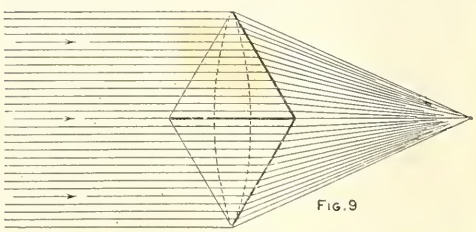


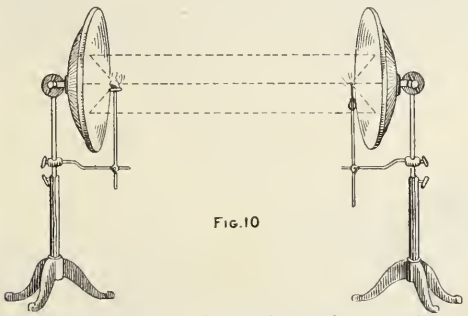
FIG. 9

Two prisms placed base to base. Dotted lines show ordinary double convex lens

coal, and the thermometer for the match, the mercury gives off more heat than it receives, and hence is reduced in temperature, and therefore contracts.

All bodies, it matters not what their composition is, radiate heat, or else absorb the same kind of rays which they give out when hot. A polished surface reflects but does not radiate. A dull surface, like lampblack, is a good radiator. A burnished coffee pot will retain its heat much longer than one that is tarnished. In other words, a good absorber is a good radiator, while a good reflector is a poor absorber and a poor radiator. As with light, radiant heat varies inversely as the square of the distance. In other words, a body placed at twice its former distance from a radiator will receive one-fourth the heat; at three times, one-ninth, etc.

Convection, the third method by which heat travels, is practically a form of conduction. Heated masses of air or water expand through the molecular action of the heat. They are therefore less dense than before, and are consequently pushed up by the descent of the colder and heavier masses. The moving particles give up their heat when brought into touch with colder bodies, and hence the statement that convection is practically the same as conduction. Heat transference in fluids is mainly by convection currents, and the circulation thus brought about produces



Reflection of heat. Parabolic conjugate mirrors. Match ignites at a distance of 10 ft. from red hot coal

the trade winds, and ocean currents. In our homes, convection plays an important part, as it is by means of this principle that ventilation and systematic heating are secured.

¶A Nebraska electric lighting plant manufactures ice as a by-product.

DYNAMITING A BELFRY OFF A CHURCH STRUCTURE

The removal of a belfry by the use of dynamite seems a rather hazardous

The Old Belfry Before the Operation

method of getting rid of it. Nevertheless it was the means resorted to when the upper structure of an old edifice at Cinqueux, France, built in the eleventh century, began to show signs of approaching dissolution, and endangered the rest of the church.

The amputation of the belfry was performed under the direction of a captain of a regiment of army engineers. Three charges of powder were exploded before the old belfry succumbed. Great care had to be taken that the entire edifice would not be irreparably destroyed, but as it was intended to give the entire structure a thorough overhauling, the slight damage to the main part of the building caused by the explosions was not a serious consideration.

The charges of powder were so placed that the inner supports of the belfry were most affected, and consequently

The Structure After the Dynamiting of the Belfry

the greater part of the heavy stone and debris toppled inward. The operation was considered very successful.

WOODEN RAILROAD BRIDGE WITH 380-FT. SPAN

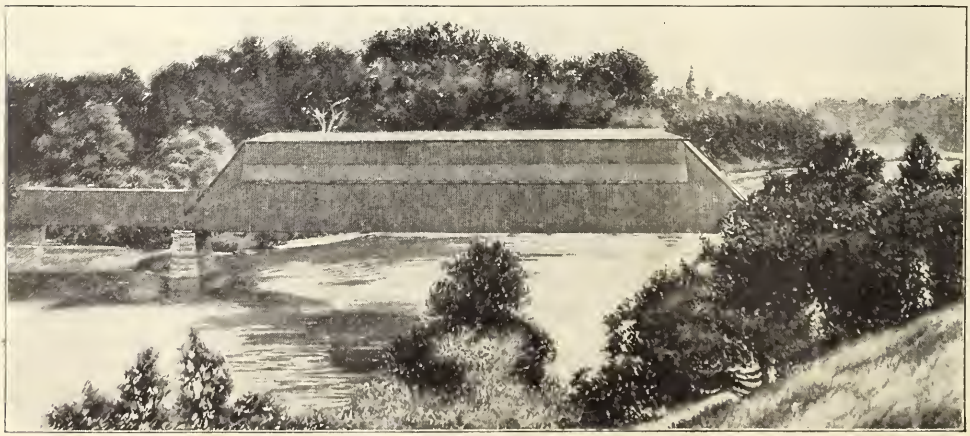
The covered 380-ft. span of this wooden bridge is said to be one of the longest of the kind in the world. The bridge is one used by the Southern Pacific railroad to cross the McKenzie river near Coburg, Oregon.

EXPORT MARKETS FOR AUTOS AND MOTORBOATS

United States consuls and a special government agent report Porto Rico, Norway and France as providing excellent fields for American automobiles and motorboats.

"The demand for automobiles in Porto Rico," says Special Agent J. M. Turner, "has been in excess of the supply. Agents have had to wait as long as three or four months for their orders to be filled, and the appropriation just made to extend uncompleted roads and join the ends of completed ones will mean a steady growth. There are at present more than 600 miles of splendid roads. The island, however, is hilly, and roads were originally built for military and heavy traffic, with little regard for easy grades. It is not unusual to find 10 per cent grades, and some maker of automobiles could easily capture the trade by turning out a machine to fit these conditions."

According to United States Consul Taylor, of Stavanger, the opening for motorboats and motorboat engines in Norway is good. "There seems to be an exceptional opportunity for both light, fast boats and the heavier more substantial class," he says.



Wooden Railroad Bridge in Oregon

Vice-Consul J. D. Wise, of Bordeaux, draws attention to the progress in motorboating in southwestern France during the past year. At Arcachon is a colony of enthusiastic water sportsmen continually on the alert for improved types of boats and engines. The bay is daily alive with pleasure boats, and although there are not many American boats or engines in use, the vice-consul believes the field is large and promising for their introduction.

Hauls in Logs from Woods, Loads Cars and Makes Spur Tracks Unnecessary

UNIQUE STEAM LOG-LOADING MACHINE

The self-propelling steam log-loading machine shown in operation in the accompanying illustration is said to be one of the most remarkable of the various types of steam log-loading machinery in service today. Its construction is unique for loading operations, as it provides for passing the empty cars and trucks through the machine on the single main track, at the same time embodying trucks and propelling mechanism for moving itself in either direction along the track.

When the machine is in position for passing the cars through to be loaded, the trucks are swung out and upward by the hoisting engine, thus allowing the machine to settle down on the four curved legs the feet of which rest upon the ties outside of the rail.

This arrangement leaves an open, free space under the machine through which the cars can be drawn at will for the purpose of loading.

It may be stated that the feet or bottoms of the curved legs are provided with flexibly connected crosspieces or shoes, long enough to cover from three to five ties each. This gives the machine an exceptionally wide and substantial foundation or base. This self-propelling steam log-rolling machine is provided with a steel swinging boom, in some instances wood booms being employed where preferred.

It is equipped with two hoisting engines of two drums each, specially designed for the purpose, one of which is for skidding logs to the track for a distance up to 1,000 ft., and the other located near the foot of the boom and having one drum to carry the hoisting or loading line, and the other to carry a cable for hauling or "spotting" the cars through the machine.

Rushing the Extra Through in the Composing Room

GETTING OUT AN "EXTRA" ON A BIG NEWSPAPER

Here is a scene in the composing room of a big newspaper. The working forces are concentrated into the emergency corner getting out "hot" news for an "extra" to be on the streets right after it happens.

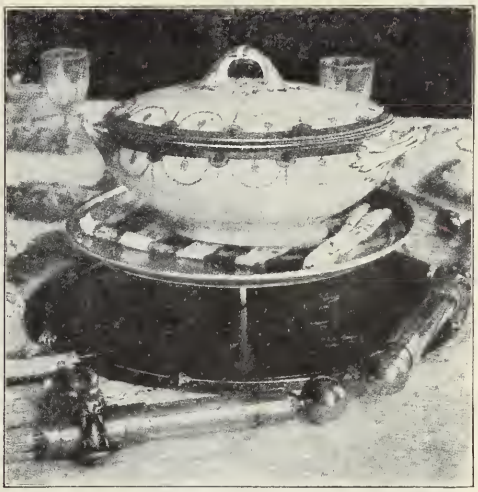
In the lower left-hand corner is the telegraph operator taking the story on his typewriter as it is clicked by the telegraph instrument on the table near his typewriter. Alongside him, seated at the same table, is the copyreader correcting the running account of the story as it comes from the typewriter. This man hands the copy to the man seated at the linotype machine. The story is cast into metal, line by line, and is then passed to the four men gathered around the "form." Three of these are make-up men, and the tallest is the editor who dictates the arrangement of the story as it is to appear in the paper.

Just as soon as all the story is complete, the metal form containing the story in type, is locked and in less than 15 seconds is in the hands of the stereotypers and in less than two minutes the big metal plates are being locked in the presses. A few minutes after the last click of the telegraph instrument the first copies of the papers are on the streets.

DISHES SERVED BY ELECTRICITY

The wonderful electric house of Mr. George Knapp, in Paris, France, in which the owner can be served with anything he wants from a book to a meal in any room in the house by simply pushing a button, can hear everything going on in any part of the house and see approaching visitors before they gain the entrance, has been described in this magazine before. But many new things are continually being added, one of the most interesting being the means by which dishes are made to appear on the table.

The chef prepares each dish in its proper order and has it ready waiting on a tray. When the host and his guests are seated at the table, the former touches a button and the electrically operated tray arrives through a trap



The Electric Serving Tray Coming Through the Table

door in the top of the table. When closed, this trap looks like two ordinary silver covers on the table. By pressing another button, the tray, with its dish, is carried around the central portion of the table, the slender support traveling through the channel which is seen in the illustration. As the dish arrives in front of each guest, the host touches a third button which stops it while the guest is helping himself. The dish passes all around the table in this way, and then, on again pressing the first button, it disappears through the table and returns to the kitchen.

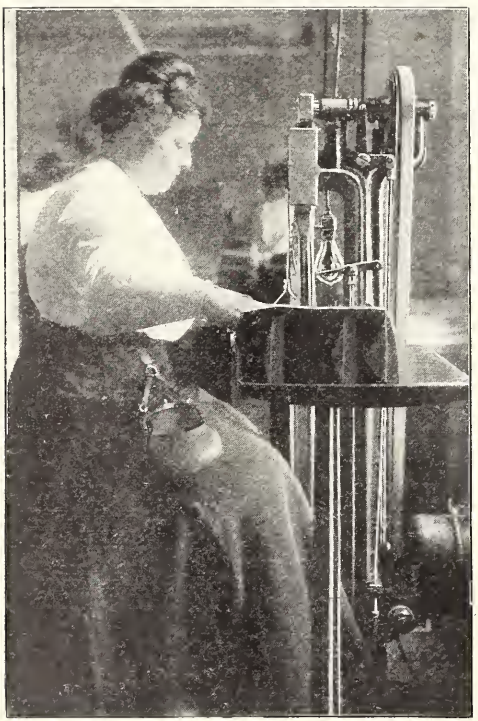
CAST-STEEL WHEELS FOR AUTOMOBILES

A concern in Manchester, England, is making wheels of cast-steel for taxicabs and light automobiles with the rim, hub and spokes cast in one piece. The wheels are of the same weight as wooden wheels, and can be fitted to standard axles.

In casting the wheel much care had to be taken to secure equal expansion and contraction, especially while in the annealing furnace.

UNCLE SAM'S NEW MONEY-MAKING MACHINES

After more than a year of study and experiment the mechanical experts of the U. S. bureau of engraving and printing have perfected two remarkable new machines which will, to a great extent, revolutionize the manufacture of currency as conducted by the Treasury Department at Washington. When a full complement of the new inventions has been installed, on or before July 1 of this year, the innovation will have the effect of displacing more than one hundred employes of Uncle Sam's money factory and saving the government about $140,000 in wages alone. This economy is due to the fact that the new machines are largely automatic in action. As a secondary consideration, only a little less important, the operations of money manufacture will be so simplified and concentrated by the new equipment that 70 machines now in use will be dispensed with entirely and there will be a great saving of floor space.



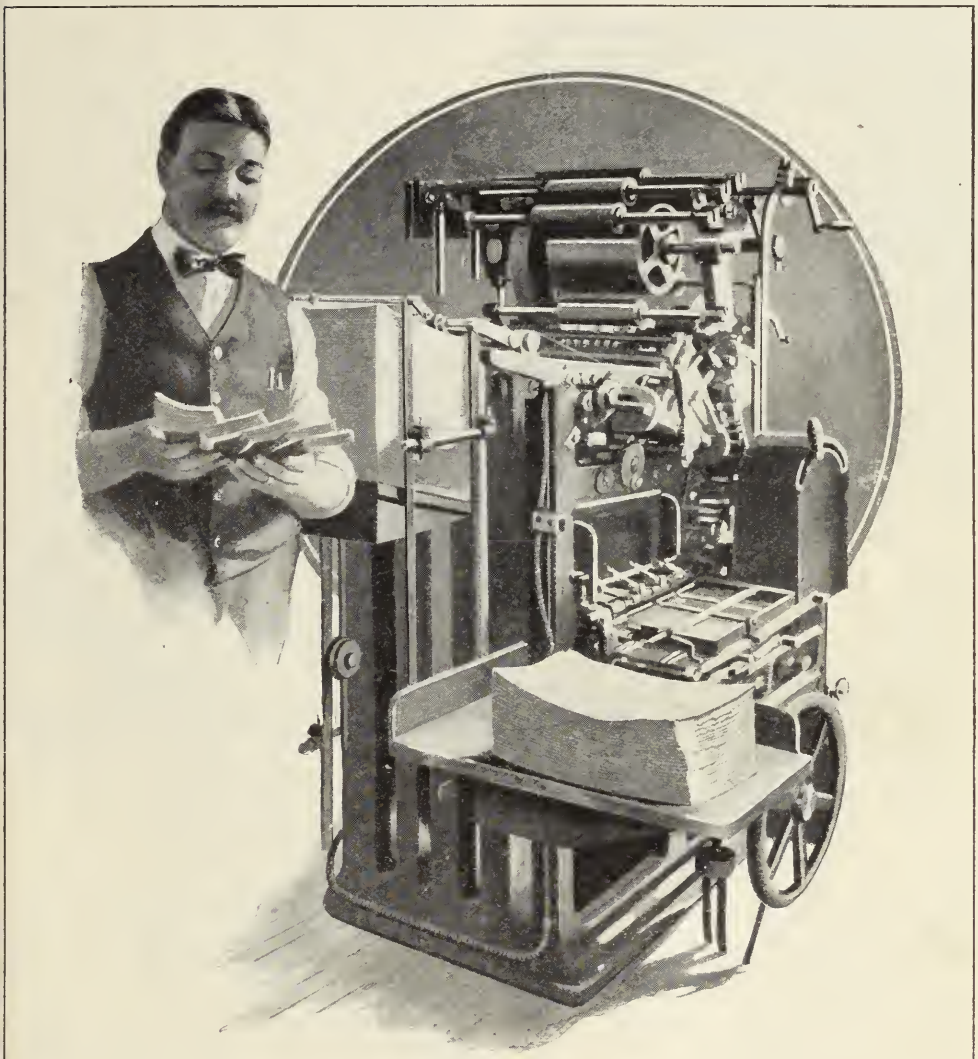
Currency Trimming Machine, Invented to Order of Government

When the officials of the government set out to promote economy by discovering a "short cut" for money manufacture, it was found that there were problems involved not presented by any other form of printing. For instance, the special paper upon which our currency is printed is subjected to so many successive wettings and dryings in its transit through the bureau of engraving that it becomes badly "buckled" and moreover no two sheets seem to be affected in exactly the same manner by this contraction. In order, therefore, to permit of automatic manipulation in all the later processes of currency manufacture it became necessary to first devise some sort of machine that would bring about uniformity in the sheets.

This boon has been obtained in the marvelous new trimming machine just invented at the bureau. This machine trims each sheet of bills on all four margins, and, more important yet, locates the printed matter in the center of the sheet so that there is an assurance of perfect register. The function of the second of the new machines may be surmised from its name—the combination numbering, sealing, separating and collating machine. It performs five different tasks, and is so nearly absolutely automatic in the performance of these duties, that there is required the services of only one man as compared with two men and four women, heretofore engaged in these operations.

Under the old plan one machine placed on the newly made paper money the successive serial numbers to be found at either end of each bill; another imprinted in color the official seal of the Treasury Department; a third separated the four bills of which each sheet is made up; then human hands had to gather together the individual bills, and finally another employe had to count the bills. Now this

new combination machine does all these various things at what is, in effect, one operation and does it in a fraction of the time formerly required. been done in the past. Moreover the feeding of the money into this comprehensive mechancal toiler is done automatically from a magazine that holds



New Money Maker, Called the Numbering, Sealing, Separating and Collating Machine

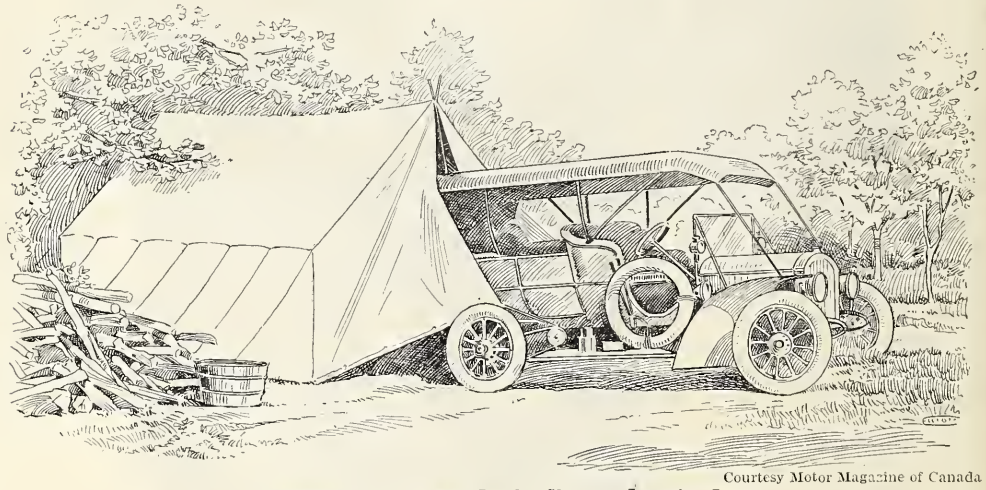
Indeed the machine, performing all five functions, handles currency at the rate of 3,000 sheets, that is 12,000 bank notes per hour. That is twice as fast as any one of these operations,—say the sealing or numbering—has 9,000 sheets. The government will require about 15 of the combination machines and 40 of the new style trimmers, but the outlay for the new equipment will not exceed $80,000 which will be saved twice over in a year.

AUTOMOBILE EQUIPPED FOR HUNTING TRIP

The illustration shows a 50-hp. automobile being used for game-bird hunting in Maine and part of New York and other states in the East.

The back part of the machine is provided with a lower and an upper berth, running lengthwise of the car, the upper berth folding back in the daytime. In addition to the sleeping quarters provided by the commodious interior arrangement of the automobile, the equipment includes a tent, 18 ft. long and 9 ft. wide, which is stretched from a ridge pole. Usually in making camp the car is backed with the rear of its top beneath the end of the tent, as shown in the illustration. By removing the boxes and the folding table from the automobile, and setting up the stove in the tent, the interior of the former auto is adapted for sleeping and the tent for living purposes. The tent is lighted at night from a storage battery, the energy of which is renewed when the automobile is running. At the rear of the chassis is located an ice box in which about 40 lb. can be carried, while the special locker and box space within the body provide room for all stores required.

With this automobile the hunters can drive to the places where the game is known or believed to be, and quickly make their camp. After a couple of days in one locality, the equipment is packed, and the party is off for another locality a hundred or so miles distant, or even in another state.



Courtesy Motor Magazine of Canada

Arrangement of Tent and Car for Short or Lengthy Camp

AUSTRIA VALUES RADIUM AT $35,000,000 PER POUND

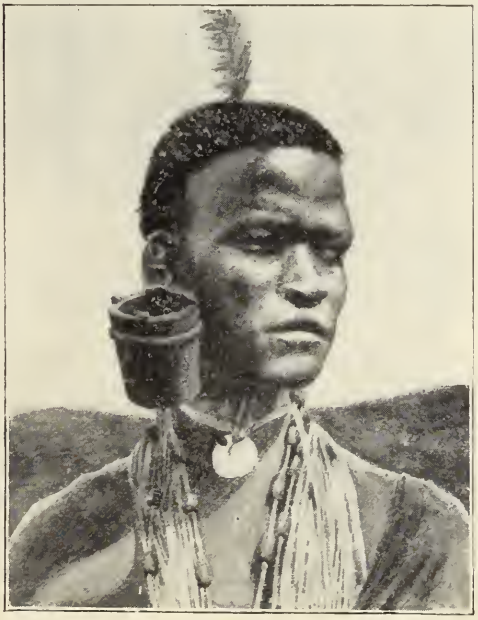
The one place where radium is produced in commercial quantities is Joachimsthal, Bohemia, which, in the 15th century, was a flourishing silver camp. The radium laboratory belongs to the Austrian government, which fixes the price of the rare mineral, but the announcement that it produces it in commercial quantities must not be misconstrued. Just how small commercial quantities may be is well illustrated by the fact that it was only recently that a second gram of radium was finally produced. It takes 1,000 grams to make a kilogram, and one kilogram is but 2 1/5 lb. The price of radium fixed by the Austrian government is 400 crowns ($81.20) per milligram, and it takes 1,000 milligrams to make a gram. Consequently, one kilogram, (2 1/5 lb.) is valued at $81,200,000, which makes a pound of radium worth $35,000,000. Even this stupendous figure is said to be relatively cheap, and the U. S. Con-

sul at Nuremberg, Germany, speaks of it as "only $35,000,000."

To purchase radium from the Austrian government money is not the only requisite, for in order to guard against the misuse of the same, this rare mineral will be sold only to scientific institutions or learned men. Delivery is made at the risk of the purchaser, and as yet there are no rules regulating the use of the mails for such purpose. Up to date not even a single milligram has been sent by mail. It has always been forwarded by a special messenger, assistants in the government laboratory being trusted with the tiny capsules for safe delivery.

HALF-PINT BUCKET AS EAR ORNAMENT

This Kikuyu boy of East Africa has a toy bucket of about a half-pint capacity as an ear ornament. Inconceivable as it may seem, it is not hung by a hook from the ear, but is encircled by part of it. What appears to be an ordinary

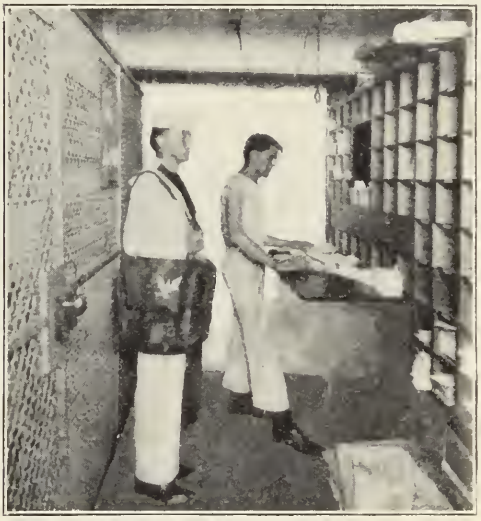


Extraordinary Earring

retaining band around the bucket is the lobe of the ear, which has been stretched to the required size.

POSTOFFICES ON BATTLESHIPS

An innovation on battleships is a postoffice in which the mail for the crew is sorted and distributed. On some of



The Most Popular Place on the Ship

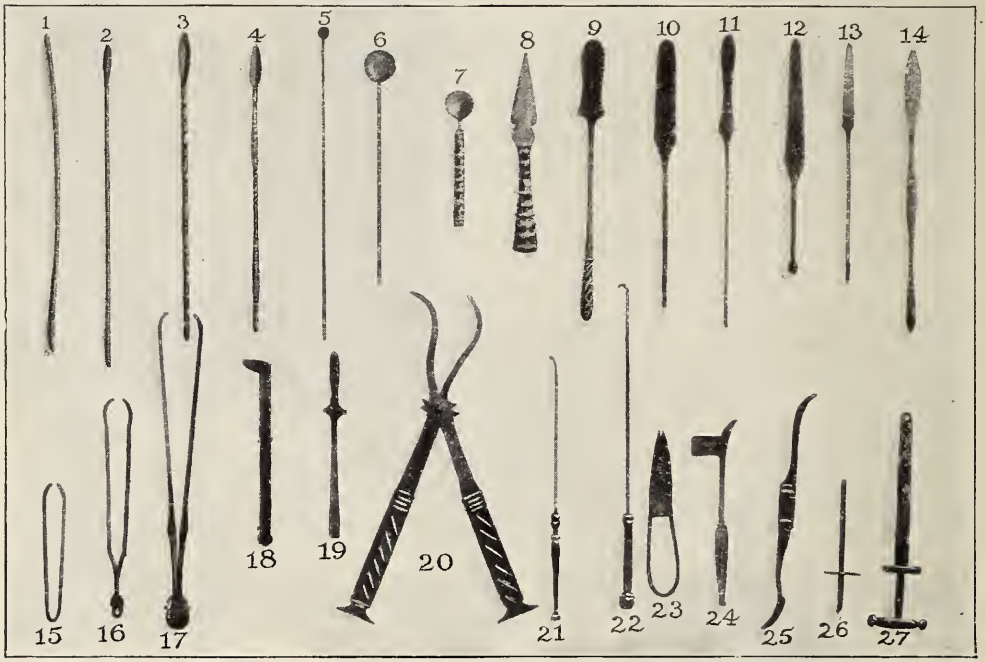
our larger fighting ships there are five or six hundred men doing regular service, a population that would make a good sized town. Heretofore the work of handling the mail has been done without a postoffice, but by the co-operation of the Navy and Postoffice Departments, arrangements have been made for the installation of an office on every large ship, one of the ship's crew serving as postmaster.

A VEST-POCKET TIRE PRESSURE GAUGE

One of the latest automobile novelties in England is a tire pressure gauge which measures the pressure that is actually in the tire. It is about the size of a pencil, and is applied to the valve after unscrewing the valve caps. A small pin depresses a valve plunger and the air forces out a little piston on which the pressure is plainly marked in pounds. The correct pressure for different sizes of tires is printed on the gauge. The device is so small that it can be carried in the vest pocket.

SURGICAL INSTRUMENTS FROM RUINS OF POMPEII

Among the many treasures and wonderful things found in the ruins of Pompeii, the famous Italian city destroyed by Vesuvius in the year 79 A. D., are a great number of surgical instruments, among which are the following in the national museum at Naples:



Pompeian Surgical Instruments

Courtesy Journal of Am. Med. Assn.

The figures from 1 to 7 are probes and spoons; 8, is a lancet; 9 to 14, spatula probes, sometimes used as cautery; 15 to 20, various forms of forceps; 21 and 22, blunt and sharp hooks; 23, scissors; 24, veterinary fleam; 25, bone elevator; 26 and 27, cannulas. Many of them are very similar to those in use today.

¶A train ferry across the English Channel, which will allow a man to board a train at London and step out at Paris, is being advocated by some enterprising Londoners and Parisians. The prospect is not bright, however, for its accomplishment.

LAWN-MOWER ATTACHMENT COMBS THE GRASS

The fact that the sod of golf courses and bowling greens in England is often covered with a considerable quantity of moss in the early spring has led to the designing of a device, to be used either with a lawn-mower or as a separate implement, that tears up the moss and allows the young grass to come up. It also tears out the hard, dry tufts of old grass, for which purpose it could be used advantageously on the golf courses of this country.

The device, which is called a moss extractor, is a light toothed wooden cylinder. It is fitted to a lawn-mower by taking out the knife cylinder and removing the sole plate. The teeth do not merely brush the top of the grass but actually comb it out, without harming the young grass.

¶A newspaper of Buenos Ayres is about to install a wireless telegraph plant at its main office.

The Wreck of the "Maine" as It Looks Today

AUTHORIZATION TO REMOVE THE "MAINE"

The twisted and broken skeleton of the "Maine," which has loomed above the waters of Havana harbor since the moment of the horrible disaster which drew the United States and Spain into war and gave Cuba freedom, has at last been ordered raised. The bill passed by the House and Senate provides that the work shall be done by the United States army engineers.

The sentiment of the country has always been for the raising of the fated vessel instead of its blowing up, so that the remains of the victims still in the hulk can be recovered.

HEAD ARMOR FOR DUELING ARMY HORSES

The time when heavily armored knights rode against each other in tournaments on heavily armored war horses is long past, but that the providing of head protection for horses taking part in such frays is not altogether of the past is shown by this illustration. The event is a sword and lance duel between contestants in the naval and military tournament held in England in May, and the horses are provided with leather head-armor to prevent injury. One horse in the illustration is rearing to help its rider avoid a blow, while the other has just swung into position for its delivery.

Courtesy Graphic, London

Protected for the Fray

¶ The switching off of the current at the central power station at Cape Town for a moment, causing a winking of the electric lights in every home, gives the residents the exact time every night.

GIGANTIC HEAD IN SMOKE CLOUD

This remarkable photograph, which shows the smoke forming a gigantic

Face in Burning Oil-Well Smoke

head, was taken while a big oil well was burning in Mexico recently. In the days of the primitive Aztecs such a face, rising from a huge neck and topped by a great wave of billowing smoke, would probably have been taken for Chac-mool, the war god of the Aztecs.

A FOOT-POWER COW MILKER

A milking machine operated by the movement of the feet instead of by power, and capable of milking two cows at once, is being used in several parts of the country. It consists of an air pump provided with two lengths of rubber hose and eight suction cups, and an arrangement for operating it with the feet. The operator sits between the two cows on an adjustable seat, and works a treadle with his feet. When one foot is pushed forward the treadle pushes the other back, the movement being about as fast as a slow walk.

Each suction cup is provided with a spigot, so that any one of them can be shut off when desired. On opening a spigot the suction of the air pump rapidly draws the cup over the teat it is held against, and the milk is drawn through the tube and deposited in a pail or other receptacle.

ELECTRIC CHURCH SIGN ON BUSY STREET

The minister of a church in a western city was anxious to overcome the disadvantage of a poor location, as his church was situated on a side street about a block away from the main thoroughfare. Therefore, he caused to be erected across the sidewalk of the busy street a modern electric sign, operated by flash apparatus. The proprietor of the building on the corner leading to the church refused to allow the sign on his building. But special permission from the city council made possible the placing of the sign on poles at the curb line. The entire flash-

This Church Sign Draws Attention

er, motor, switch, meter, and cut-out are mounted on one of the poles in an iron box.

The sign is of the same type as those erected by merchants and draws much attention.

French Aero Club's Recognition of Mme. de Laroche

FIRST AERIAL PILOT CERTIFICATE GRANTED TO A WOMAN

Mme. de Laroche, a French woman who has made numerous and successful aeroplane flights, is the first woman to be granted a certificate as an aviator. The illustration shows the certificate granted her by the Aero Club of France. As a means of identification it is necessary that a photograph of the person granted the certificate be reproduced upon it.

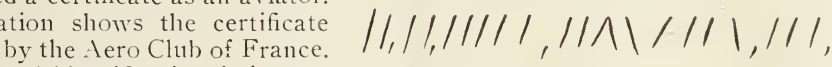
JUMPING AT A CONCLUSION

The clerk in a prominent Omaha, Neb., hotel was busily engaged making out a bill for a guest when a man walked up to the desk, picked up a pen, and, in a careless manner, as if trying the pen point, made a number of scratches on the hotel register, thus:

Throwing down the pen he was using as if in disgust, he tried another, and continued to make scratches on the book.

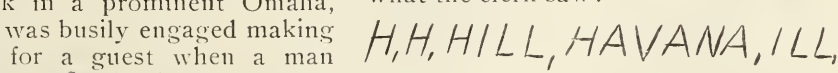
"See here," exclaimed the clerk, "this is not a school boy's copy book. It's the register."

Ignoring the remark, the man continued to make more scratches, until the line on which he was working looked like this:



"Maybe this will suit you," said the exasperated clerk, handing the visitor a new fountain pen.

"Thank you," said the man, and he made some horizontal lines. Then he turned the book around, and this is what the clerk saw:

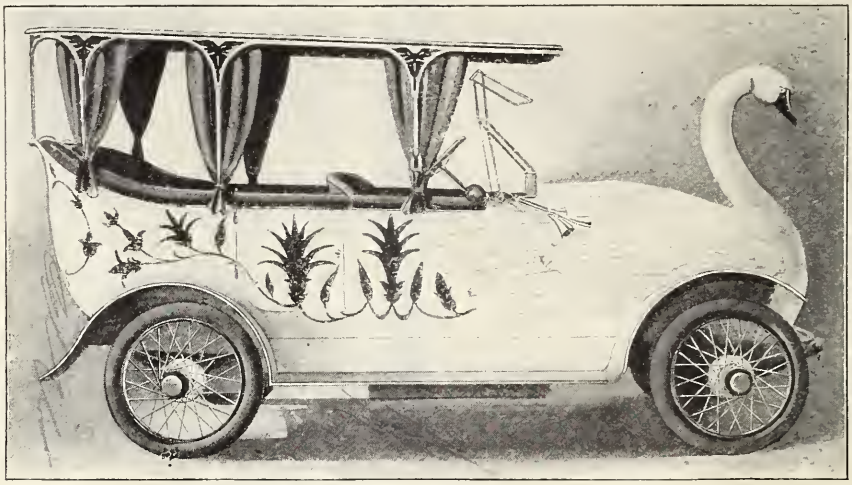


The clerk apologized profusely, and in his embarrassment gave Mr. Hill a room and bath for the price of a single room.

Statistics prove that there is 50 per cent less loss of life on the water than on land by rail and trolley in comparison to the number of passengers which are carried.

AUTO WITH SWAN-LIKE BODY

A lover of the fantastic has purchased an automobile for use in India that has a body built in imitation of the body of a swan. The exhaust from the engine, which is located in what would be the chest of a real swan, is carried up through the neck and out of the beak. The eyes of the imitation swan are electric lights with powerful reflectors that send the beams a considerable distance ahead. The exhaust can be made to emit a sound peculiar to the swan.



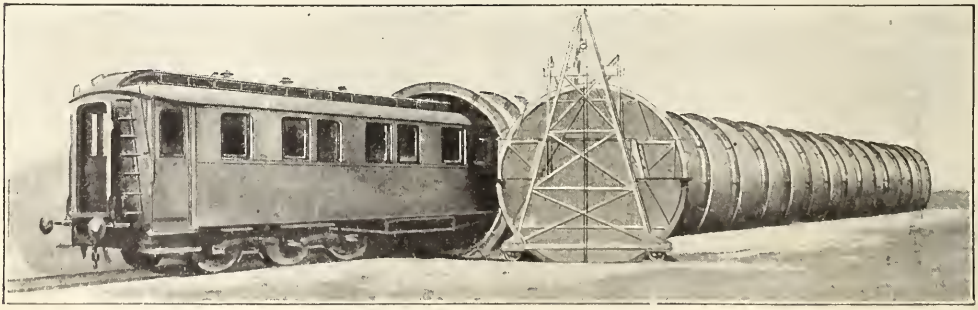
Swan Automobile

DISINFECTING TUBE FOR RAILROAD CARS

The disinfecting of the interiors of railroad cars was not considered sufficient by the Prussian state railways, and a tube system has been devised by which both the interior and exterior of a car is subjected to a treatment of formalin, a most powerful disinfectant. The cars are run into the tube one at a time, the end of the tube is closed, and the interior is filled with formalin.

HEAT AND VENTILATION IN COURTROOMS

A unique system for control of heat and ventilation in courtrooms has as its main feature two little electric switches on the bench or judge's desk, one to regulate the amount of fresh air circulated through the room, and the other to control the heat. With such an arrangement the judge can modify the conditions without having to call the attention of an attendant and interrupt the proceedings.

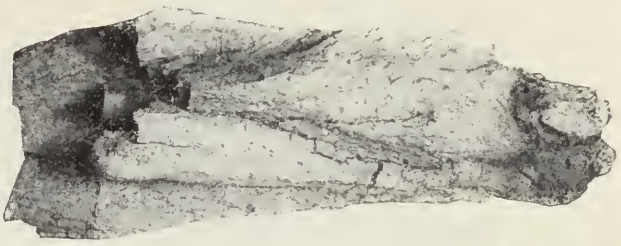


Disinfecting Railway Cars in Prussia

DEVELOPMENT IN COKE MAKING

By Guy Elliott Mitchell

Some fine results have been attained from a series of government experimental tests in making coke out of coal which it had been supposed could not be coked—a modern example of bricks without straw. The industrial significance of this fact can be recognized when it is known that coke has been shipped half way across the continent whereas it can now be made from coals mined right at the point where the coke is needed.



A Piece of Coke Made by the United States Geological Survey From Supposedly Non-Coking Coal

Anthracite or hard coal is the highest type of coal. Bituminous or soft coal is a less perfected piece of carbon, but if it will coke it may be as valuable. Both hard and soft coal may be found in the same seam or stratum, derived from the same source and of the same geologic age. In the early upheavals of the mountains, millions of years ago, the regions subjected to the greatest pressure and heat due to the folding and titanic squeezing of the rocks produced the best coal.

Thus anthracite may be found in the steep mountains; bituminous, where the slopes are more gentle and where there was less pressure; and still farther away from the center of the internal uplift, where the land's surface grades off into a plain, the stratum may be low-grade lignite, which is but one step removed from peat or wood.

While anthracite is the most valuable coal for house-heating purposes, bituminous coal which will make coke is of far greater importance to the country. In the government valuations of the public coal lands, anthracite and coking bituminous coals are given equal and the highest rank. These bituminous coals are valuable, not for making kitchen cooking coke but metallurgical coke.

To the housewife coke is a spongy-looking by-product of the city gas trust, the remnants of coal after the illuminating gas has been extracted, which furnishes a good summer cooking fuel. But this is quite a different article from the 50,000,000 tons of commercial coke which is produced annually to be used in metallurgical reductions. In the manufacture of structural steel, steel rails, etc., a fuel is required from which the gases have been driven off, hence the need of coke for these processes.

Fifty years ago charcoal and anthracite coal were used in metallurgical work, but coke has almost entirely supplanted them. So that, in this age of steel, good bituminous coal which will coke is of the greatest industrial value.

But not all grades of bituminous coal can be made into coke. It must be high-grade carbon, comparatively free from sulphur, and various other impurities, and up to this time Pennsylvania and West Virginia have furnished most of the coking coals. In fact it was assumed that coking coals were limited to these fields.

The tests of the United States geological survey, however, have demonstrated that the coal of many fields of supposedly non-coking kinds will, after a little preliminary treatment to eliminate the impurities, make excellent coke. The survey has made, for example, coke out of "non-coking" Colorado coal right in sections where the Colorado metalliferous plants were importing their coke from Pennsylvania, and it is now stated that a large proportion of Illinois' vast coal deposits can be economically coked.

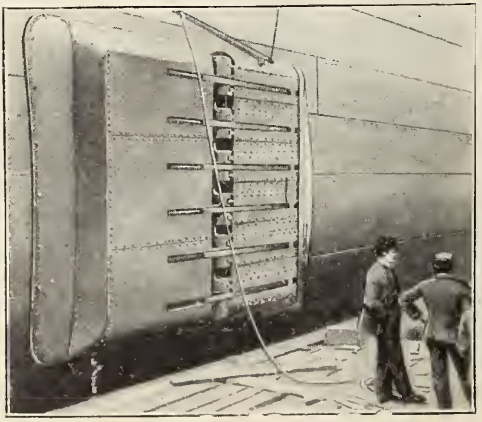
SYSTEM OF BRAKES FOR BATTLESHIPS

When it became desirable to lessen the speed of the sailing warships of the old days in maneuvering for position, an old sail, attached to a length of strong line, was thrown overboard to

Battleship Brake Open

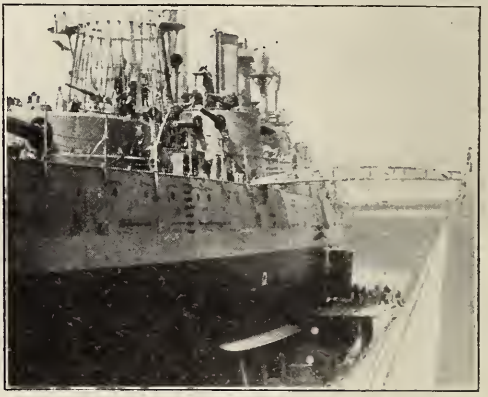
act as a drag. But this practice passed with the sailing vessel, and the great modern battleships have, up to this time, had no means other than the reversing of the propellers to bring them to a stop.

More collisions have occurred through the inability to quickly check the forward momentum of a heavy ship than any other cause, and, realizing this, a Canadian inventor a few years ago designed a ship brake which he believed would stop a vessel within its own length. Very little was done with the invention at the time, but the United States navy department has now become interested and recently gave it a test on battleship "Indiana."



The Brake in a Closed Position

The main feature of the invention is a pair of wings, or gates, as they are called, attached one on each side of the ship. The wings are made of steel, and lie against the ship's hull, pointing forward. Under ordinary conditions they are held against the hull by means of catches on horizontal bars, but, when released, the force of the water rushing past spreads them out and thus a double brake is formed. In conjunction with reversed propellers these brakes are said to be capable of stopping a large battleship within its own



View Showing Position on Ship's Side

length, while, with only one of the wings open, a ship can be turned around in about one-third of the time it has taken hitherto.

Near the other edge of the brakes are heavy steel struts, pivotally attached to the gates. It is claimed that the gates will swing into operation without jar and that the terrific resistance against the seas does not damage the adjacent plates in the hull.

When the gates swing out, a number of sliding plates attached to the lever shafts drive into covered ways, and in so doing carry a certain amount of

water with them. This water, which is compressed in the covered ways by the movement of the sliding plates resulting from the pressure of the seas on the gates, acts as a water cushion. As the pressure is more and more exerted under the terrific strain, the water is allowed to escape through the perforated ends of the covered ways.

The Engine and Some of Its Fuel

A BRUSH-BURNING ENGINE

Under difficulties that would discourage any one but a hardened prospector, an oil company has been boring on the Mojave desert in California. The absence of fuel was one of the greatest obstacles, as traffic conditions there are primitive and the only natural fuel thereabout is sage brush. This has been utilized under the boilers, however, and the method of obtaining it is rough-and-ready, but effective. A long railroad rail was used with a team hitched to each end. This was dragged broadside across the desert, breaking the bushes off at the ground. A horse rake was used to collect it in piles, and the strange fuel was then hauled to the engine. Two thousand acres of desert have been denuded of sage brush for this purpose, keeping six horses and four men busy.

NIGHT CUSTOMS SHIFT FOR NEW YORK

The faster service across the Atlantic in the past year, and the opening of the well-lighted Ambrose channel, has frequently resulted in the docking of several of the larger liners around 11 and 12 o'clock at night, and consequent long hours for the customs inspectors. To work 18 and 20 hours out of the 24 as a regular thing, however, is out of the question, therefore New York is to be made a permanent day and night port.

The innovation will mean an increased government expenditure for the port of $375,000 annually to provide for additional inspectors, collectors, surveyors, and clerks for night work.

¶While undergoing trials on the Clyde recently, a new twin-screw suction hopper dredger, built for the Argentine government, drew up a cannon ball, weighing 30 lb. which wrecked the internal machinery.

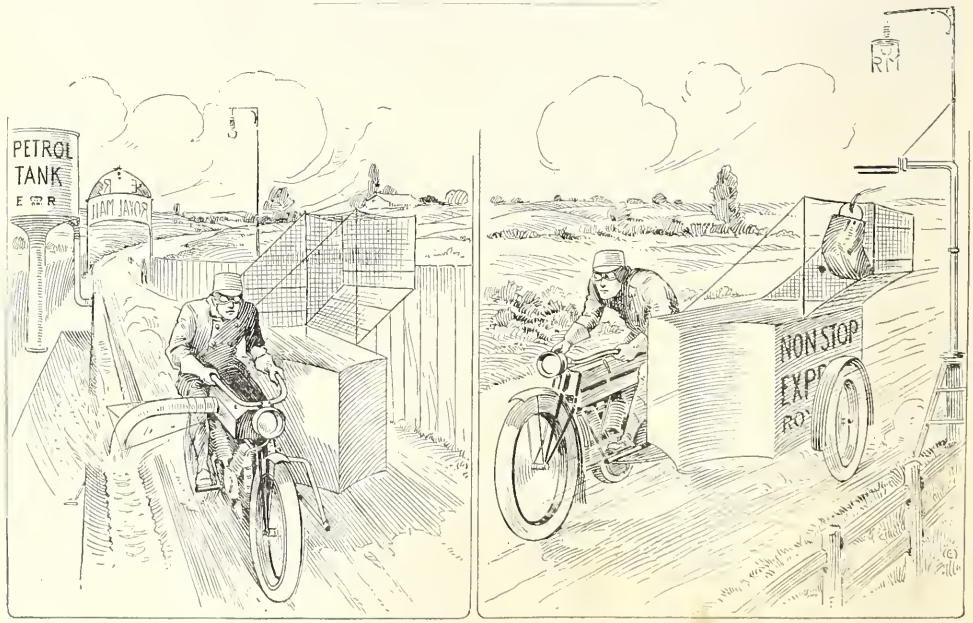
TRANSPORTING 77-TON CASTING ON CAR OF BUT 50-TON CAPACITY

A unique and successful method of transporting heavy castings on cars of much less capacity than the weight to be carried, has been adopted by a Manchester concern. On two occasions recently, castings weighing 77 tons were transported from Manchester to the Middlesborough docks for shipment to Japan on 50-ton cars, the excess weight being distributed over two other cars by means of the cantilever arrangement shown in the illustration, and still two more cars being used to underrun the counterbalance weights.

Five tons of packing was first placed on the 50-ton car, and the 77-ton casting placed on this, making the weight to be carried 82 tons. Oak beams, for leverage, were made fast to each end of the load-carrying car, and these were carried over the 40-ton cars on each side. At the outer ends of each of these beams were hung 9-ton counterbalance weights. These weights swung over small well-cars without being attached to them in any way. The oak beams were 2 ft. square, three of different lengths being used on each side.

Transporting a Heavy Casting on an English Railway.

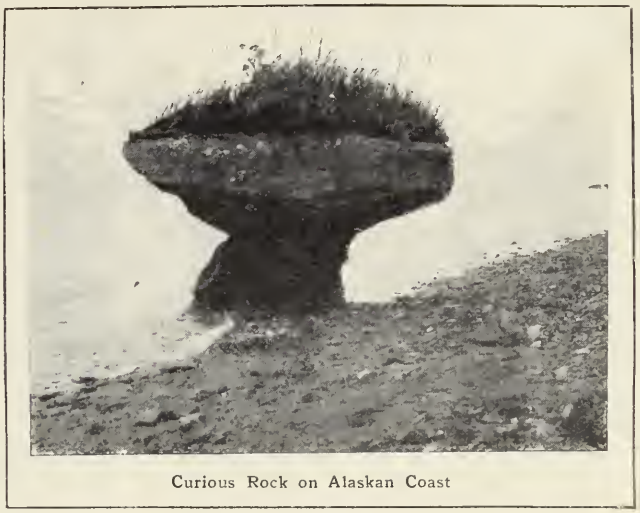
¶A La Porte, Ind., concern values the services of its superintendent so highly that it has taken out an insurance policy of $100,000 on his life to protect itself against loss by his demise.



NON-STOP MOTORCYCLE POSTAL SERVICE—The motorcycle is proving very efficient in the English postal service. Motor Cycling, London, suggests a non-stop service, showing how gasoline and mail could be taken on while going at high speed.

"MERRY WIDOW" ROCK

Among the many photographs taken by Professor Atwood, of the United States Geological Survey, who was making an investigation of Alaska coal deposits last year, was this one of a peculiar rock on the Alaskan coast. The tide was just lapping its base when the photograph was taken. It was named the "Merry Widow" rock because the grass and flowers growing upon its flat top gave it the appearance of a Merry Widow hat.



Curious Rock on Alaskan Coast

SUBMERGING CARS TO UNLOAD MOTORBOATS

One of the many things that point to the wonderful spread of motorboat enthusiasm in every part of the country where proper water conditions prevail, is the action of the Delaware & Hudson Railroad in constructing a marine railroad spur running into the waters of Lake George, N. Y.

Lake George, of course, is only one of the thousands of watering places, and the amount of boating upon it must be considerable to make the construction of a special launching track by a railroad practical. The flat-cars upon which the company transports motorboats, or sail boats for that matter, to the lake are run into the water upon the special track until they sink to the depth required to allow the boats to be floated off. The track extends far enough into deep water to allow a boat having a 6-ft. draft to be floated clear.

Millions of Flying Foxes

FLYING-FOXES IN AUSTRALIA

One of the most peculiar sights of the northern territory of Australia is the swarms of flying-foxes that often fill the sky in every direction for hundreds of yards. The thickly growing trees are often loaded with millions of the bat-like little animals, and when they leave the trees on excursions for water the sky is darkened.

Flying-fox is the popular name given the "colugo," a peculiar East Indian mammal with a wing-like membrane similar to that of the bat.

UNITED STATES PATENT SYSTEMS VS. FOREIGN PATENT SYSTEMS

By John P. Carson

AT a recent hearing before the committee on patents of the United States House of Representatives in connection with a bill providing for the creation of a new board of appeals in the Patent Office, Commissioner of Patents Moore made some statements which seemed to reflect upon the patent system in vogue in this country as compared with the laws and practice in Great Britain and in Germany. He is quoted as stating that about 60 per cent of the patents issued by the Patent Office are almost worthless in whole or in part. This statement if taken literally would indicate either that our patent system is very faulty, or that the administration of the Patent Office in the granting of patents is very lax, or that the patent profession is very incompetent, or that a combination of these conditions prevails.

It should be understood that Commissioner Moore was making a plea for legislation increasing the power and responsibilities of the Patent Office and naturally presented his case in the light most favorable to his contention.

If it is a fact that 60 per cent of the patents issued by the Patent Office are almost worthless, then the fault lies largely at the door of the Patent Office, for it has the granting power.

The history of patent litigation shows that during the past four years only 29 per cent of the patents litigated were found to be invalid in whole or in part and that the entire number of patents litigated during these years, 427, is only a fraction of one per cent of the patents issued during that time. As the court records are practically the only means of ascertaining what proportion of patents are worthless, it will be seen at once that the Commissioner's statement is unsupported by the records. It should also be remembered that of this 29 per cent a large proportion of the patents were found to be valid in part, that is as to certain claims, and invalid as to other claims, hence the patents as entireties were not void.

The system prevailing in this country of allowing a number of claims in a patent, each claim covering a complete structure which might alone constitute a patent, accounts for the situation stated in which some patents are found to be partially invalid and partially valid. This system does not prevail in Great Britain and Germany. Owing to the large number of applications for patents presented in the United States Patent Office, a number greatly in excess of those presented in Great Britain and Germany combined, it is practically impossible for the examiners of the United States Patent Office to conduct the thorough and complete examinations which are made by the corresponding officials in the British and German Patent Offices. The greater number of patents applied for in this country is due in part to the facility with which patents are obtained and the greater ingenuity and inventive ability of American inventors as compared with their brothers across the seas. There are undoubtedly defects in the patent system prevailing in this country which could be cured in part by legislation, and most of which could be covered by reforms within the Patent Office just as there are similar conditions in the Patent Offices of Great Britain and Germany. Man-made laws and rules are seldom perfect and to admit defects is not equivalent to a confession of failure.

These are some of the things that might be done in the opinion of the writer with resulting benefits both to the inventors and the public:

1st. Preliminary examinations by a corps of clerks in the United States Patent Office, with a view of ascertaining the probable novelty of inven-

tions submitted for such examinations, the government charging a reasonable fee for this service.

2nd. The establishment in the large cities of Patent Office libraries where full copies of patents are kept and classified in the same manner that now prevails in the Patent Office at Washington, D. C.

3rd. The raising of the standard of requirements of attorneys practicing before the United States Patent Office to a point where only those specially qualified by mechanical and legal knowledge and experience could be admitted to practice.

4th. Increasing the salaries of the Patent Office examiners so that men of experience and high attainments could be retained as examiners.

5th. The establishment of courts of patent appeals in the various United States Circuits, such courts to be presided over by judges having the necessary mechanical and legal training to especially fit them for considering the technical details involved in the average patent suit. Such judges to have exclusive jurisdiction in patent litigation and to be limited to such cases. Provision for taking the testimony of witnesses orally in the presence of the court of exclusive patent jurisdiction.

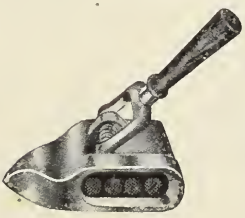
6th. The establishment of a censorship in the Patent Office of the advertising literature sent out by patent solicitors.

Some of these measures would seriously interfere with the business of certain classes of patent attorneys, and would probably be opposed by financial interests that depend for their commercial supremacy largely by dominating the market with patents and expensive patent litigation.

To return to the statement of Commissioner Moore, it would probably be found by comparing the administration of the Patent Office with the administration of any other bureau or tribunal conducted by our Government, that it is as free from fraud and faults as the best of them; that there is less fraud, imposition and deceit practiced in that bureau than in some other bureaux of the Government; that the personnel of the examining corps and officials of the Patent Office ranks as high as that of any other Government office either in this country or in Great Britain or Germany, and that considering the difficulties and factors involved, our patent system is superior to that of any other country in that it attains the primary purpose of a true patent system, to-wit—the encouragement of advance in the sciences and arts so that the public may be benefited by improvements in all things that tend to better the general welfare.

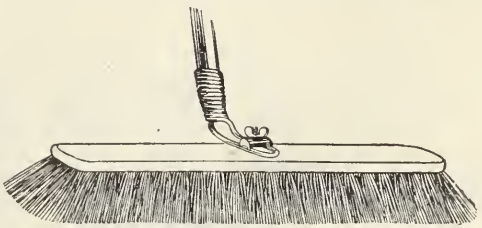
NEW ALCOHOL FLAT-IRON

An alcohol-heated folding flat-iron, designed especially for polishing and fancy ironing, such as is required for lace collars and handkerchiefs, is being manufactured. It folds up into a small space for convenience in carrying. In the center of the iron are four indestructible retort wicks, which are said to absorb sufficient alcohol to heat the iron in three minutes.



SPRING-HANDLED FLOOR BRUSH

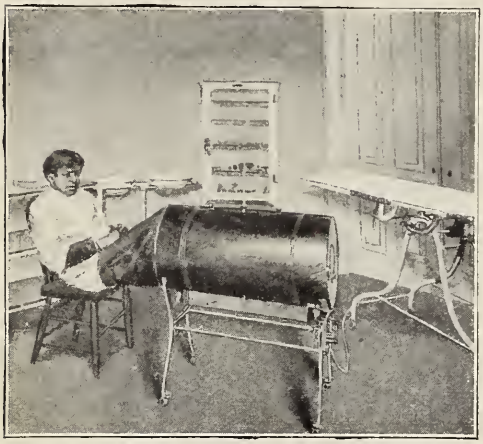
The purpose of this spring handle for a floor brush is to make the brush spring slightly at the end of every stroke, thus shaking from it the clinging dust and preventing tracking.



Floor Brush Shakes Itself

STERILIZING WOUNDS IN AN ELECTRIC OVEN

Electric sterilizing ovens, at first used only for the sterilization of dental and surgical instruments are now used



Patient Undergoing Treatment for Sterilization of Wound

to some extent to sterilize stubborn wounds or ulcers.

The illustration shows such an oven in the operating room of a Chicago physician. The heat penetrates the tissues in a way that surface antiseptics cannot, and even though the temperature is run up to 500 deg. F., which is nearly 300 degrees higher than the boiling point of water, the skin is not scorched. As the heat increases in the oven, the skin of the patient protects itself by throwing off a profuse perspiration, which prevents scorching.

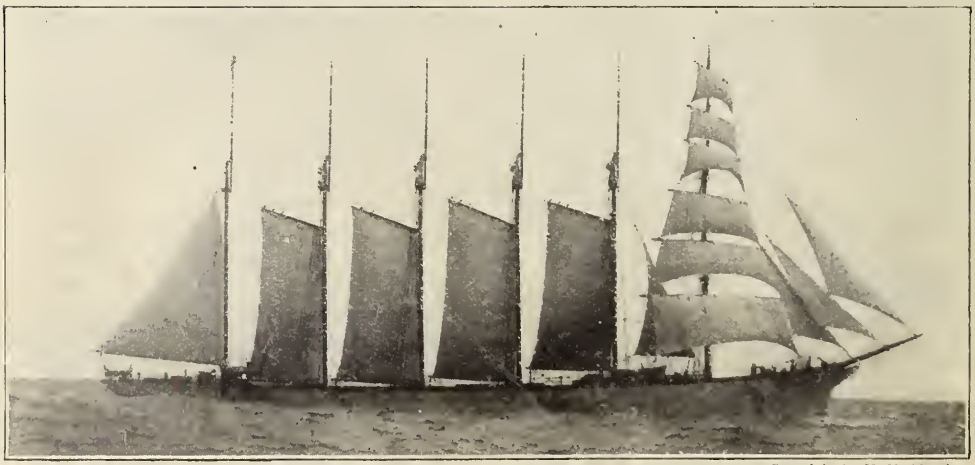
SIX-MASTED VESSEL WITH BARKENTINE RIG

The "Everett G. Griggs," a six-masted vessel with a barkentine rig has just returned from a globe-encircling voyage and is now lying at a Puget Sound port, taking on a cargo of lumber for South Africa.

She was formerly the four-masted English ship "Lord Wolseley," which was overtaken by a hurricane outside of Cape Flattery and left a virtual wreck. The dismasted vessel was purchased by an American syndicate and was thoroughly overhauled and re-rigged.

Figuring that the vessel could be much more economically run as a "fore-and-after" than a ship, the vessel was fitted with six masts, five of which were schooner-rigged, and the foremast equipped with yards.

In one respect the hopes of her new owners were realized, as 17 men were required to handle the vessel in place of the 34 formerly needed. In the matter of speed, however, she has been somewhat of a disappointment, as her voyages have been far from record-breaking. She is also said to be somewhat cranky and hard to handle.



Just Returned from a Globe-Encircling Voyage

Copyright by H. H. Morrison

SHOP NOTES

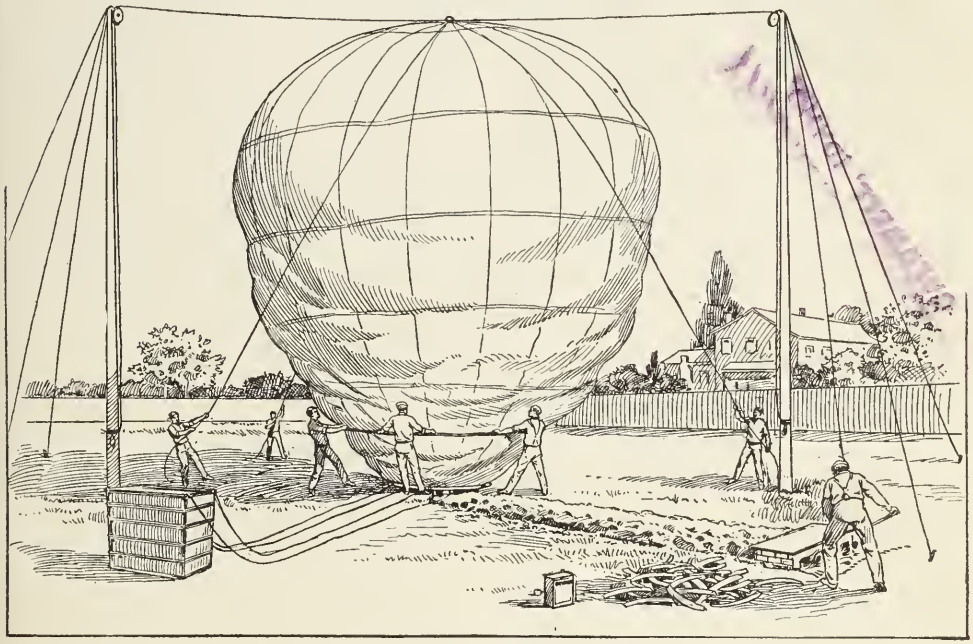
Aeronaut's Hot-Air Balloon—Part II

How to Inflate and Fly a Balloon

Having finished making the balloon, as described in a previous chapter, everything is ready for inflating and making a flight. Obtain the use of a field of suitable size, one that is in a sheltered place if possible. The best time to make a flight is in the afternoon of a still day.

Procure two poles about 35 ft. long. Each one can be made up of two pieces, joined the same as in making a high flagpole, but in either case they must be strong enough to carry the weight of the balloon. Each pole must have a pulley block at the top end, through which to pass the hoisting rope. This rope must be at least 120 ft. long to allow the part between the poles to sag and reach the ground where the balloon is to be raised. Put the rope through one pulley block and pass it through the ring in the top of the balloon, then put it through the pulley block on the other pole. Place the poles 42 ft. apart and guy each one with three ropes from the top. Each guy rope should be about 45 ft. long.

Dig a trench 2 ft. wide, 2 ft. deep and about 20 ft. long, beginning at the center between the poles. Place some pieces of heavy sheet metal over the top and cover with earth about 6 in. deep. Make a chimney of brick or sheet metal pipe about 2½ ft. in diameter over the end of the trench between the poles. At the other end of the trench make a clear place about 4 ft. square for use as a fireplace.



Inflating a Balloon

Place the opening of the balloon over the chimney and pull the top end up by

the hoisting rope as high as possible. Have a number of your friends take hold of the band that was sewed on the balloon for the purpose, and place a boy inside to direct them in keeping the cloth away from the chimney, also to give instructions to the fireman or inflater in regulating his fire. Start the fire in the fireplace of the trench, using old barrel staves as fuel, and throw a little kerosene on at intervals until the balloon is well heated and "stands on its feet," so to speak. During this period of inflation keep the cloth well out from the chimney and the ring around the opening close to the ground. The men holding the band can stand on the ring. The bag now crawls out and the hoisting rope is loosened and pulled away. If the wind is blowing enough to carry the top of the balloon around or to one side, the poles must be taken down.

The balloon is now ready for the ascent. The aerial passenger can use a trapeze or a basket, as he desires. If a basket is used, it must be attached to the ropes of the balloon before the inflation is started. Procure a strong, square luggage basket and fasten it securely to the ends of the four 12-ft. ropes attached to the bottom ring of the balloon. These ropes are laid out from the balloon's mouth to their full extent on the ground. The passenger must get in and take a secure hold on the basket to prevent being thrown out as it leaves the ground. The fireman now throws gasoline on his fire. This must be done with care, using a tin cup and keeping the receptacle away from the flames. This will give extra lifting power to the balloon. It is now time to make the start and shouting, "Get ready everybody," the fireman stops firing and places a cover on the entrance of the fire tunnel. Then with a "Let go everybody" the balloon rises upward and reaching a height of about 4,000 ft., gives its passenger a panoramic view of the surrounding country for many miles.

After about 10 or 15 minutes the balloon starts to cool and slowly descends, and, if in clear country, its passenger will make an easy landing. Care should be taken to hold the balloon, else it will rise again when freed from the load.

A Handsaw Depth Gauge

When sawing notches for joints, it becomes necessary to have some kind of a gauge to stop the cutting at the proper depth. Gauge saws can be purchased, but the small amount of use required for them will not warrant the keeping of the extra saw. The illustration shows a clamp gauge for use on any saw. In Fig. 1 is shown the construction of each clamp, and in Fig. 2 the assembled parts on the saw blade. The two gauge bars are fastened to the lower ends of the clamps with glue. When this clamp is set for a certain depth it is held in place by driving two wedges in the top ends of the clamps. —Contributed by Otto Borman, Jr., Philadelphia, Pa.

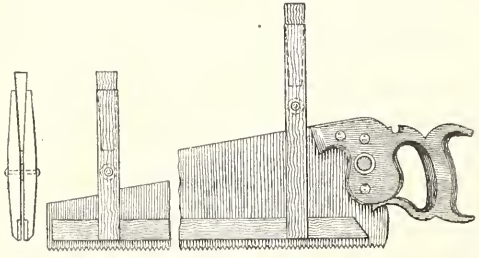


FIG. 1 FIG. 2

Gauge on a Saw

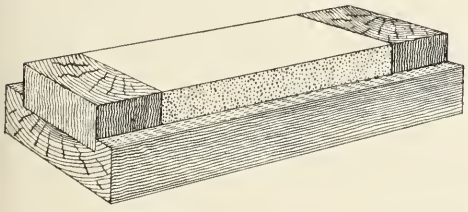
Inexpensive Concrete Culvert Forms

A new method of constructing concrete road culverts was devised by the commissioners of a township in Lee county, Illinois, using empty salt barrels for forms. A ditch is first dug 1 ft. wider and 18 in. deeper than the diameter of the salt barrel, and at either end of the trench an excavation is made about 1 ft. wide and 1 ft. deeper than the culvert trench and overlapping the culvert bore about 10 in. on either side. The concrete is filled into the excavations at the end and a bed

of concrete, 6 in. thick, is placed in the trench and smoothed off to form the bed of the culvert, with a grade of about 1 in. to 5 ft. Empty salt barrels are placed on this bed of concrete, end to end, allowing the heads of the barrels to remain in and the open end being supported with a piece of board to prevent crushing under the load. The concrete is placed in and well tamped at the sides, filling up all the space and 6 in. over the tops of the barrels. The culvert should be at least 6 in. below the grade of the road and after the concrete is set, dirt is filled in to make the grade level. The concrete consists of a mixture of 1 part cement and 7 parts sand and gravel, with sufficient water to make it rather wet. The heads in the barrels and board props can be removed with a long pole. The staves need not be removed as they will drop out in time.

Setting an Oil Stone in a Block

Oil stones wear away and make a hollow in the center caused by the bulk of the rubbing coming at that place. This can be corrected if the stone is set in a block, as shown in the accompanying sketch, with pieces of hard wood, about 2 in. long, set in at each end, their surfaces flush with the face of the stone. This will enable the workman to whet over each end of the stone as well as in the middle, thus wearing it away evenly. Should the stone show any hollow places after long use, take a piece of fine sandpaper and lay it

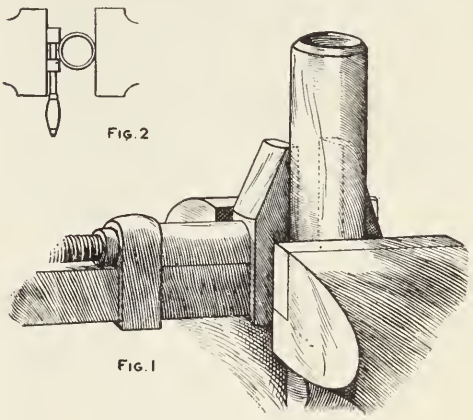


Hardwood Block at Each End

flat on a board, turn the stone face down and rub it briskly. This will dress the high places down and make the surface level.—Contributed by Wm. Lutzenburger, Dayton, O.

Holding Rods and Pipe in a Vise

All shops are not provided with a pipe vise, and in its place the arrangement shown in the sketch will prove useful in holding bolts, rods and pipes



Holding Round Pieces in a Vise

from turning while threading them. Take a common monkey wrench, open the jaws sufficiently, and clamp the rod or pipe and wrench in the vise in such a way that the surface of the rod or pipe is forced against the corners of the wrench jaws. This is shown in Fig. 1. The way the wrench is put in the jaws of the vise is shown in Fig. 2. When the vise jaws are drawn together the rod or pipe cannot turn in either direction.—Contributed by A. W. Augestine, Stromsburg, Nebr.

Cleaning Automobiles Without Water

Owners of automobiles should know that the less water used about a machine the better. Any metal part (except brass) unpainted is liable to rust, and water is no friend of rubber tires. A greasy rag or waste cleans off dust quickly and leaves the surface bright. Mud dried on cannot be removed in this way, but the spots can be carefully soaked off with a damp sponge.

¶The addition of cadmium to soft solder composed of tin and lead, lowers its melting point and increases its strength.

Jig for Removing Valve Seats

Having occasion to frequently reseat brass valve seats in pumps, and finding it difficult to keep an edge on the wide cutter which is generally used for that purpose, I made a jig, the details of which are shown in Fig. 1, to remove the valve seats so that they could be faced off in a lathe.

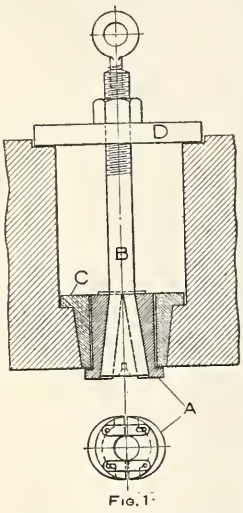


FIG. 1

A bushing, A, has a tapered hole, and B is a bolt with the head turned to fit this hole, and the other end threaded for a nut. The bushing is cut in two lengthwise, and enough stock removed at the lower part to allow it to close sufficiently at the bottom to slip through the hole in the valve seat C. The two halves are held together by means of two small straps across the top as shown in the lower plan view. A bar D, with a hole in its center for the bolt stem to pass through, is placed over the valve chamber. After the nut is placed on the bolt an eye is screwed in the end of it to facilitate its handling. When a strain is put upon the nut and the bar tapped with a hammer the valve seat will readily pull out.

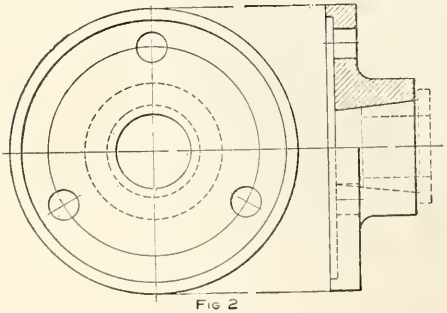
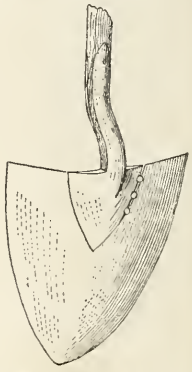


FIG 2
Valve Jigs

I also made a jig as shown in Fig. 2 for holding the valve seats in the lathe for facing. The back is counterbored to fit over the driver faceplate of a lathe, and is bolted to it. The hole is bored to correspond to the taper of the valve seats so they will fit in place tightly. After facing off the seats they were removed by tapping them with a rod through the hollow spindle of the lathe.—Contributed by M. P. Chitterbuck, Chicago.

Repairing a Broken Shovel Blade

The lightest and best shovels often break where the handle is fastened to the blade, leaving a crack that makes the shovel useless. The break can be repaired easily by putting a rivet or two in the crack and hammering them down. A shovel can be made as strong as ever by repairing it in this manner. If rivets are not at hand cut a spike in two about ½ in. from the head. This will make a very good rivet.—Contributed by Peter J. Taft, Clovis, Calif.



How to Anneal Novo Steel Cutters

When milling cutters have been ground and reground until the teeth are entirely gone it is the usual practice, in most machine shops, to anneal the cutters and recut them, making them smaller but just as good as new. Much difficulty has been found in trying to anneal novo steel but the following method has proven very successful: Secure a cast-iron box, and a quantity of cast-iron chips, such as are found around a planer or shaper. Pack the novo cutters in the box, placing some of the cast-iron chips around the edge of the box and between each cutter. After the box is filled, seal it with fire clay and place in a hot furnace for five hours. If it is convenient to leave the

box in the furnace over night to cool, much better results will be obtained. In any case the box must not be opened until it is cold.—Contributed by Chas. E. Klink, Lemoyne, Pa.

How to Prevent a Scythe Handle From Turning

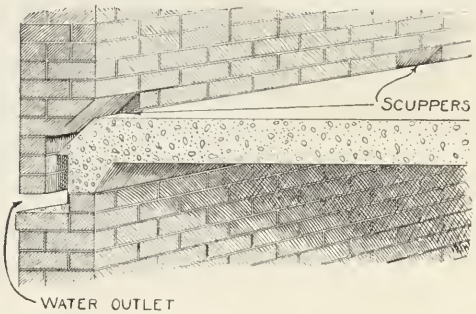
Place the handle in the desired position on the snath and screw it up as tight as possible. Drive a three-penny nail into the opposite side of the snath, leaving about ⅛ in. of the head projecting. Fasten one end of a wire to the nail and turn the other end up over the snath and around the handle, pulling it tight all the time, then bend

Handle Wired to Snath

it around and under the snath, then up and around the other side of the handle, and back to the nail again, where it is fastened securely. Drive the nail in to tighten it a little. This will hold the handle in place firmly and will not split the snath or blister the hands as where fence staples are driven in over the loop.—Contributed by B. Orlands Taylor.

Scuppers in Brick Walls

In case of a fire in a factory there is generally more damage done to the contents by water than by the fire. Especially is this true on concrete floors. Scupper openings should be made in walls carrying such floors to allow a free outlet for the surplus water to run away on the outside of the wall. This is necessary to protect the contents of the rooms below. The illustration shows the section of a brick wall and concrete floor through one of the scupper openings. The openings are formed with wood wedges which

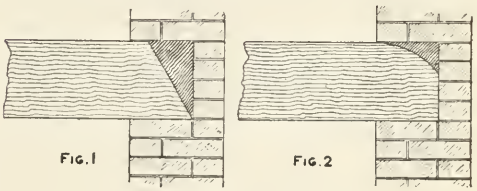


Scuppers to Drain a Cement Floor

are removed after the concrete has set. The rise at the end of the concrete prevents the cold air entering the building in the winter.—Contributed by Fred W. Hogloch, Akron, O.

Cutting the Ends of Joists

The ordinary way of cutting the ends of joists for entering a brick wall is shown in Fig. 1. If they are cut as shown in Fig. 2, they will be more effective and time will be saved in the cutting. The joists can be all laid without sawing them. The carpenter places his rule or compass on the lower edge of the joist at the intersection with the inside surface of the wall and describes an arc with a radius equal to the width of the joist. The corner of each joist is cut off on the line with a hand axe,

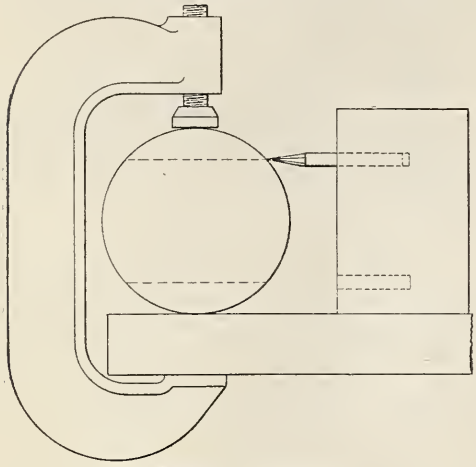


No Brick Rest on the Joist

making them rounding as shown. In case the building burns, the joists will fall without disturbing the wall as no bricks rest on the ends of the joists.—Contributed by E. C. Walker, Toronto, Canada.

How to Find Two Opposite Points on a Sphere

A simple method of finding two diametrically opposite points on a ball is shown in the accompanying sketch. The ball is clamped to a perfectly flat



Marking the Circles

surface, such as a faceplate or a marble table top, with an ordinary clamp. Secure a wooden block about the height of the ball and bore two holes in it, one near the top and the other near the bottom as shown. Fit a lead pencil in one of the holes and by moving the block about the ball trace a circle on its surface. Now place the pencil in the other hole and trace another circle in the same manner. The centers of these circles, which are easily found with a pair of dividers, are plainly the opposite ends of a diameter of the ball or sphere.—Contributed by C. W. Nieman, New York City.

How to Find a Sprinkler Leak

Not long ago an engineer had a sprinkler system extended into a new building in his plant. It was of the dry type with compressed air pumped into the pipes to hold back the water, says Practical Engineer. When completed they filled the system with air at 85 lb. and, behold, after two days there was only 35 lb., which same ought not to have happened for over six weeks.

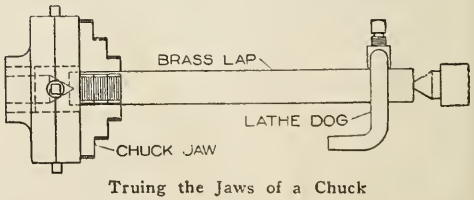
Soap lather treatment to the joints could give no hint of the location of that leak—but it was there just the same.

Our friend, the engineer, was a man of resources, and says he, "We'll chloroform the leak, and that'll put it to sleep so we can catch it napping easy." So he forthwith got 3 oz. of ether, poured it into the suction of the air pump that filled the sprinkler pipes and started the pump, in which case the ether went into the sprinkler pipes.

Foremen of the departments were warned to watch for the odor of ether, and report to the engineer. A day passed and no report; the ether wasn't yet working. But on the second afternoon word came that the leak was etherized and captured in a joint on the old system close to the new addition, caused probably by the strain when installing additional piping. So much for perseverance and using one's think tank. If you can't do a thing one way, do it two ways.

How to True Universal Chuck Jaws

A simple and inexpensive method of truing universal chuck jaws that have become badly worn and out of line, is shown in the accompanying sketch. Turn up a brass lap in the lathe so the centers will be perfectly true. Place this in the chuck and hold it between the lathe centers, as shown. It is to be kept from turning by a dog placed at the opposite end, and resting on the tool post support. Screw the jaws lightly against the lap, then apply oil and emery, and revolve the chuck.



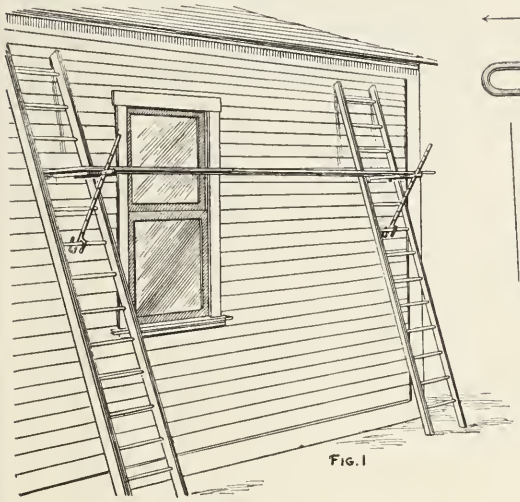
Truing the Jaws of a Chuck

The jaws will be ground perfectly true in a very short time by this method.—Contributed by J. Weaner, Plainfield, N. J.

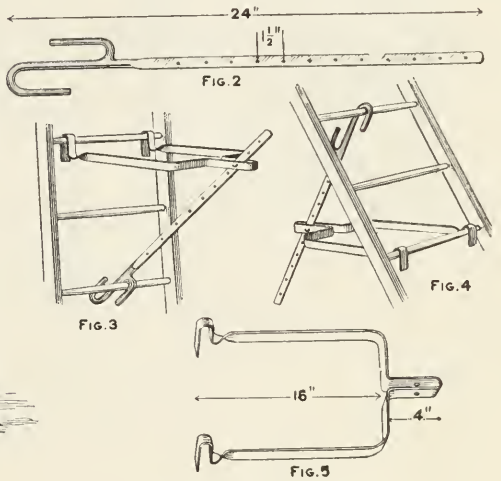
Ladder Attachments for Making a Scaffold

Painters who work on frame houses and do not have a swinging stage will find the ladder jacks shown in Fig. 1 a great help.

Each jack is made of ⅜-in. iron in two separate parts, the brace, Fig. 2, and the staging support, Fig. 5. These parts can be adjusted to any angle by taking out the bolt and raising or lowering the staging support to the desired position. The jacks are hooked on the rungs of the ladder as shown in Fig. 3. This is the usual position, but they can be reversed and used on the back of the ladders as shown in Fig. 4. For small places on the sides of buildings, sign work, etc., this jack will be found very useful.—Contributed by W. B. Smith, Guelph, Ontario.



The Scaffold in Use



Parts to Make the Jack

Bending Castings

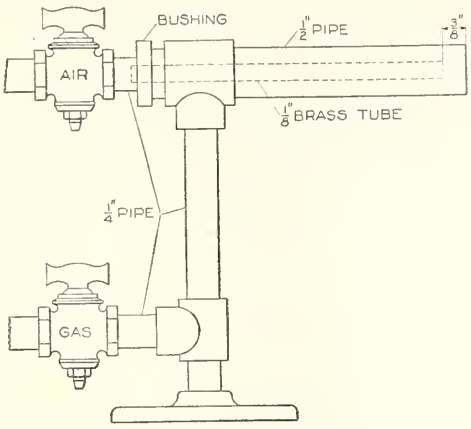
Anyone who has had anything to do with metals knows that castings of iron or steel, or the various yellow metal compositions, possess one characteristic in common—that of brittleness. Under great strain they bend but little and when pushed to the breaking point give little warning before a fracture. This property of brittleness prevents a piece that has been cast crooked from being straightened. The result is that innumerable castings are discarded annually. Heating and hammering the casting does not help the matter. It is possible, however, to straighten or bend castings when hot by use of the slower and more cautious method of weighting. Take, for instance, the case of a plate that has been warped in casting and which should be straight. This plate could be heated red hot, laid on another flat surface convex side up and a weight placed on the "hump." By giving the proper amount of weight the casting can be slowly and surely straightened. It may be convenient in some cases to fasten down one end of a casting leaving an overhanging end to which a weight is suspended by a wire.

The same results could be secured by the use of a press where pressure is applied by an adjusting screw which is set up slightly as the casting changes its form. I have used these methods with unfailing success on iron and steel castings and have saved time and money by avoiding delay in getting new castings.—Contributed by Donald A. Hampson, Middletown, N. Y.

¶Never run cutters backward in a milling machine.

A Blowpipe Made of Pipe Fittings

A blowpipe that can be made entirely of pipe fittings, which can be screwed together in a very short time,

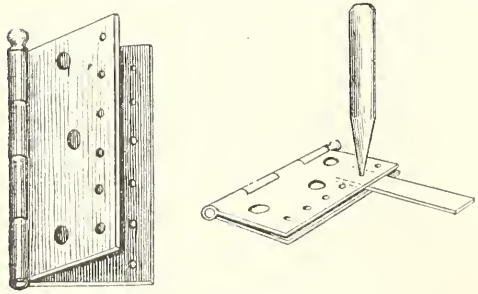


Made Entirely of Pipe Fittings

is shown in the accompanying sketch. By adjusting the air and gas cocks, a needle point flame or a powerful blast may be readily obtained with sufficient heat for light brazing. One advantage of this torch is that it cannot be blown out no matter how small the amount of gas nor how powerful the blast of air.—Contributed by S. W. Morrison, Baltimore, Md.

A Tool for Punching Holes in Springs

Take an ordinary hinge, 1½ by 3 in., close it and drill five or six holes about $\frac{5}{16}$ in. from the edge. Start with a $\frac{1}{16}$-

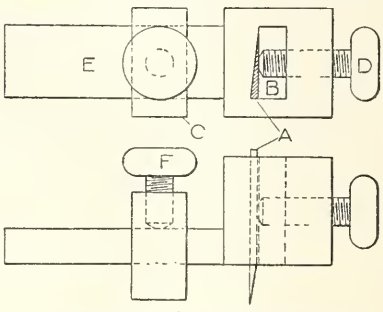


Punching Holes in Springs

in. hole first, then $\frac{3}{32}$, ⅛, and so on, until you have the sizes you wish. Secure or make a punch to fit each hole drilled. Countersink the top part of the holes just a little. Mark the spring where you want the hole and put it between the hinge, close the wings and adjust the spring so the mark will appear in the hole. Take the right sized punch and drive it through the hole and spring. The punch will cut a smooth round hole without cracking the spring.—Contributed by Rud R. Karich, Brooklyn, N. Y.

A Belt Lace Cutter

A simple attachment for a pocket knife blade which converts it into a belt lace cutter is shown in the accompanying sketch. The knife blade, A is held fast in the slot B by means of the setscrew D. The circular collar C is made to slide along the arm E and regulates the width of the lace to be cut. It is locked in place by the setscrew F. This cutter has proved to be superior to



Lace Cutter Attached to Knife

many of the patent cutters now on the market.—Contributed by H. W. Brooks, Shafter, Texas.

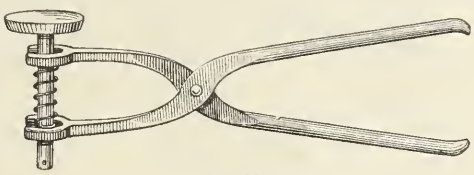
Removing Chatter Marks

Work taken from a machine with chatter marks on it will not be found perfectly true. When turning a piece in a lathe it sometimes seems impossible to remove the marks from the metal with a tool and with each succeeding cut the tool makes grooves in the same place. When the tool used has been ground with the top rake slanting to the right, change the rake to the left and it will remove the marks,

as the cutting edge will strike the lines of the chatter at right angles to the old marks, thus cutting through them instead of following the lines. In turning slender pieces the chattering can be stopped by increasing the feed a little more than usual.

Tool for Removing and Replacing Valve Springs

Removing and replacing valve springs on gasoline engines to regrind leaky valves is a very aggravating job on most all engines where a proper tool is lacking. Several different types of valve spring lifters have been invented and placed on the market. However, it can be readily seen that the tool illustrated can be applied to most any valve where the spring is accessible. They are made similar to a blacksmith's tongs and should be about 14 in. long, forged from $\frac{7}{16}$-in. round stock. The forked ends should have a U-shaped opening of about ½ in. The tip ends should be tapering to permit it being pushed between the coils of the spring easily. This tool can be quickly made and it will be found valuable to those



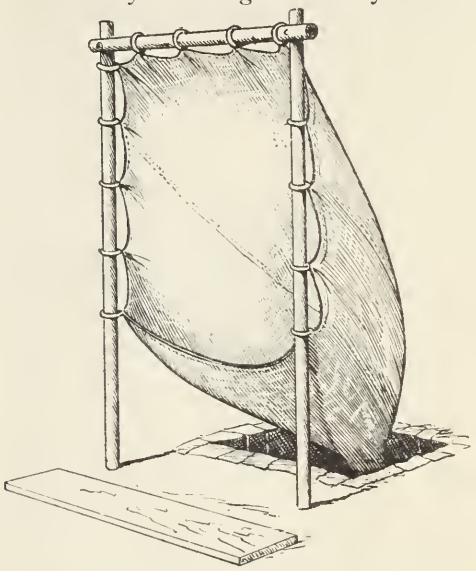
Spring Holder

who have occasion to repair automobiles.—Contributed by L. A. Cuson, Detroit, Mich.

Supplying Fresh Air to Well Diggers

In localities where firedamp exists underground, it is a difficult and dangerous undertaking to dig a well as the digger often loses his life by entering the deadly gas, which, being heavier than air, is found at the bottom of the well. If firedamp is suspected, a lighted candle may be lowered to the bottom of the well and if the gas is present the candle will be extinguished.

A method of furnishing fresh air to the person who is working down in the well is shown in the accompanying sketch. An air collecting sheet, a piece of ordinary sheeting about 2 yd. wide



Forcing Fresh Air into a Well

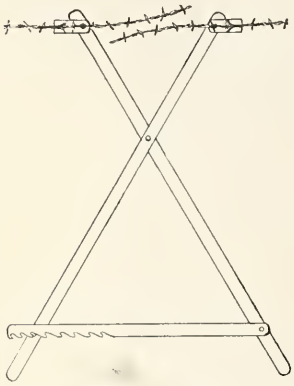
and 3 yd. long, is fastened to the posts. A pipe, 6 or 7 in. in diameter, is made of the same cloth with an enlarged funnel-shaped end which is sewed to the bottom end of the air-collecting sheet. Hoops are placed in the cloth pipe at suitable distances to keep the pipe open for the free passage of air. The edges of the air sheet should be reinforced so it will stand the pressure of the wind. The end of the cloth pipe should hang near the digger's head.—Contributed by A. M. Bryan, Corsicana, Texas.

How to Repair a Sagging Door

Doors frequently sag to such an extent that the latch will not engage with the mortise in the jamb. This annoying defect may be corrected by placing an object, such as a file tang, vertically between the outside edges of the wings on the lower hinge and closing the door easily, but firmly. This will spring the lower hinge sufficiently to raise the door so as to accomplish the result desired.—Contributed by C. W. Nieman, New York City.

Splicing a Wire Fence

This device shown in the accompanying sketch is very handy for holding the wire of a fence while making a splice. It is made of two hard wood sticks or bars of metal, 3 or 4 ft. long, which are bolted together as in making a pair of tongs. Two small clips are bolted at the shorter ends of the bars. These are made like a hook to hold the wire. After placing the end of the wires in the clips they are pulled together in the same manner as closing the tongs. The bars are held together while making the splice by a crosspiece fastened to one bar and notched to fit a pin in the other bar.—Contributed by W. C. Parker, Olaf, Iowa.



A Potato Paring Knife

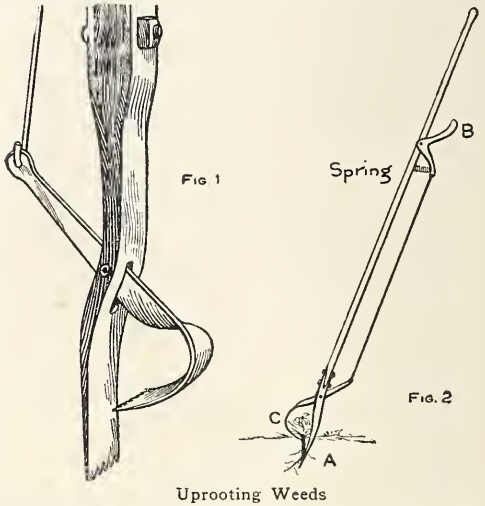
When the "eyes" of potatoes are deeply indented, the housewife has considerable trouble to pare them evenly. The ordinary paring knife has a pointed blade, and to clean the "eyes" the point has to be circled around the eye-pit.

The illustration shows how a wide knife blade may be ground down so as to leave a triangular "eye-cutter" near the butt of the blade. After a potato is pared the knife is held crossways in the hand and the spur of the blade set in each eye and twisted back and forth or revolved. The eyes are thus pared out evenly and with much saving of the edible part of the potato.—Contributed by Thaleon Blake, Sidney, O.

Eye-Cleaning Paring Knife

A Lawn Weeder

This new weeder shown in Fig. 1 makes a useful addition to lawn and garden tools. It is very simple and effective for removing dandelions and other weeds that are usually found in lawns. The instrument is grasped firmly in both hands and the point A, Fig. 2, is driven into the ground just behind the objectionable weed. The lever B is then pulled, thus bringing the second blade, C, to close on the first. The root of the weed is now firmly held in the grasp of both blades and by removing the instrument from the ground the entire weed comes with it. By releasing the lever B the spring causes the blade to open, the weed drops out and the instrument is ready for another.—Contributed by W. B. Lipphard, Buffalo, N. Y.



Uprooting Weeds

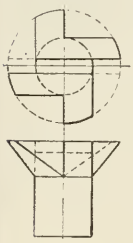
Protecting Steel Work with Cement Paste

The most efficient, durable and economical coating for steel girders in viaducts or overhead crossings to protect the steel from the corrosive action of locomotive gases is a cement paste mixed in proportion of 12 lb. pure red lead, 32 lb. Portland cement, 4 lb. linseed oil and 2 lb. drier. This mixture should make a paste like putty, and if too soft, cement and red lead are

to be added; and if too heavy, oil and drier are to be added. The iron or steel surface to be coated should be as clean of rust and foreign matter as it can be made, using either sand blast, steel brush, chisel, or sandpaper, for this purpose, according to the amount and hardness of the foreign matter to be removed. Apply one heavy coat of red lead and allow the same to set. Apply one heavy coat of Japan drier. Put the paste on this drier while it is wet. Do not allow the drier to become dry before applying the paste. The paste should be put on about ⅛ in. thick, rubbed with a trowel and pressed around rivet heads and angle flanges by hand. Cover over the paste with one coat of red lead. This last coat adds a great deal to the life of the coating, as it retards the hardening effect of the atmosphere on the paste.

Screw Head Used for a Countersink

A countersink will not cut the wood on a bevel to fit the various screw heads as the different sizes do not have the same bevel on the under side of the heads. Where the screw head is wanted to be flush with the wood and a neat fit is desired, make a temporary countersink from one of the screws. This is done by cutting the screw in two above the threads and filing the head, as shown in the illustration, to make a cutting edge. Use a brace and a screwdriver bit to turn the screw cutter in countersinking the holes. Turn the cutter down until the head is flush and it will make the exact bevel, cutting a perfect and smooth hole.—Contributed by C. L. Wall, Lawrence, Kansas.



Home-Made Wagon Tire Shrinker

Many small blacksmith shops do not have a regular tire shrinker as the cost is too great for the amount of work done on such a machine. These blacksmiths have occasion to shrink a few tires. The work can be done by using two steel clamps and an old rasp. The

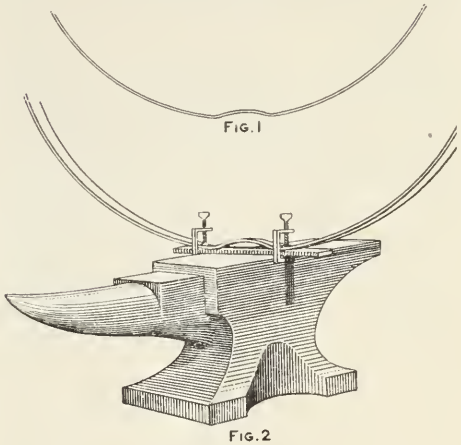
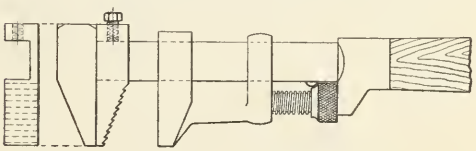


FIG. 2
Shrinking a Tire

tire is first bent as shown in Fig. 1, then heated to almost a welding heat and clamped to the rasp as shown in Fig. 2. The rasp and tire are placed on an anvil and the bend hammered down. This usually upsets the tire sufficiently to make it a tight fit on the wheel. If one shrinking is not sufficient, a second bend can be made and hammered down in another place.—Contributed by F. M. James, Dewey, Montana.

A Detachable Jaw for a Monkey Wrench

The accompanying sketch shows a detachable jaw which, when applied to an ordinary monkey wrench, converts it into a first-class pipe wrench. It is best to make it of soft machine steel and then caseharden, as it is liable to break in the yoke if made of tool steel.

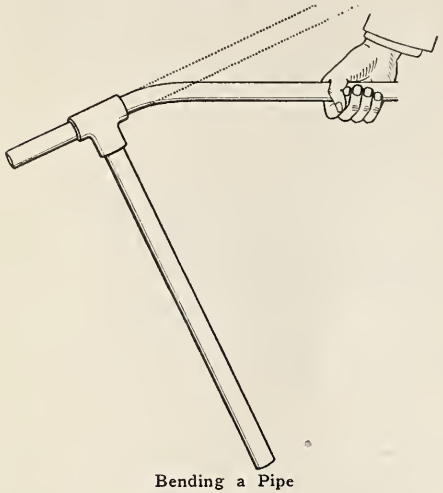


Jaw for Turning Pipe

It is held in place by means of a small set screw as shown.—Contributed by A. D. Johnson, Philadelphia, Pa.

A Pipe-Bending Tool

When putting in piping it is often necessary to make bends, turns, etc., other than those possible with elbows



Bending a Pipe

and tees. If a very slight indentation is not objectionable, a bend can be made with a tool, as shown in the accompanying sketch. A tool for bending small pipe can be made from a 3-ft. piece of 1¼-in. pipe with a tee screwed on one end. A bend is made by grasping the pipe in the left hand and with the right inserting the pipe to be bent as far in the tee as the end of the intended curve and pressing down. Pull the pipe out for successive bends until the desired curvature is obtained. This tool is very handy for conduit work on lighting circuits and is better for making a bend than a vise.—Contributed by Donald A. Hampson, Middletown, New York.

Pasting Labels on Tin

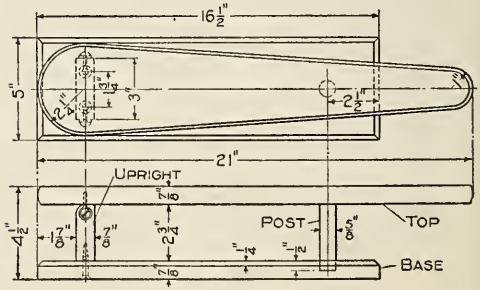
The reason that labels will curl off from metal surfaces is because the paste will contract in drying. If this shrinkage can be eliminated, the labels will stick on tin plate as well as any other surface. A correspondent of the Modern Painter has solved this problem by applying a coat of pure glycerine to the back of the label before pasting. The paper absorbs enough glycerine to prevent contraction, yet permits the necessary drying of the adhesive. Keep a convenient supply of glycerine in a wide-mouthed bottle and when required for use, tilt until the glycerine will run into the neck, then return the bottle to the vertical position. It will be found that enough glycerine to moisten the tip of a finger remains within reach. Apply with the finger to the back of the label and immediately paste over it as usual.

Sleeve and Shirt Waist Ironing-Board

The ironing-board shown in the illustration has two advantages over the kind with a fixed top. First, the top can be raised to a vertical position and the sleeve slipped over easily, and second, the top is more rigid as it is supported by an upright post.

The board is easily made from round stock, or the different pieces can be purchased from a mill, planed and cut to the size. The base is ⅞ in. thick, 5 in. wide and 16½ in. long. The edges are given a ¼-in. bevel to add to the appearance. The upright is fastened to the base with two 1¾-in. wood screws. The post is set into a ⅝-in. hole, bored ½ in. deep in the base.

The top is cut in the shape shown, and the edges made round so the cloth covering can be easily applied. The top piece must be covered with several



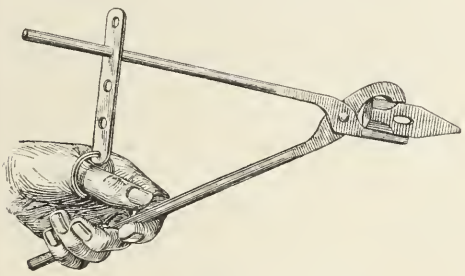
Detail of the Ironing-Board

thicknesses of cloth. Into the under side of this top board two screw eyes (preferably brass) are turned in a little over 3 in. apart, so as to clear the edges of the upright. Round-headed

brass screws are cut into the upright through the screw eyes, thus forming a hinge. This permits the top being turned back to receive the sleeve of the garment.—Contributed by Allison P. Ball, Worcester, Mass.

Adjustable Handle Link for Blacksmiths' Tongs

Some blacksmiths cannot afford to have a full line of tongs and the device shown in the illustration was designed to be used where the handles of the tongs spread beyond the grasp of the workman's hand in holding various kinds of work in the jaws. It is made of a piece of flat iron, ¼ by 1 in. and 6 in. long. Drill a ⅜-in. hole in one end and insert a ring about 1½ in.

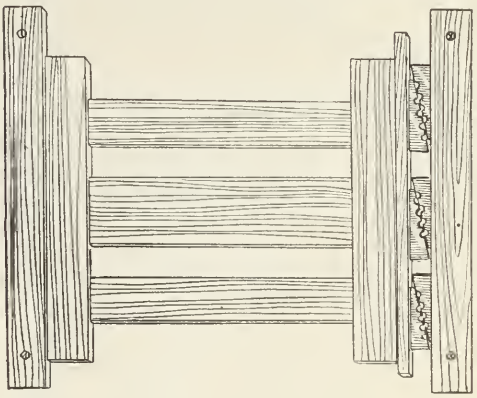


Holding Wide-Spread Handles

inside diameter. Beginning at the other end, drill four holes, each slightly smaller than the handle of the tongs. File the handle tapering so as to make a wedge fit when it is put in a hole. This will keep the device from coming loose when the tongs are thrown down. —Contributed by M. Kakara, Streator, Illinois.

Quoins Used for Cabinet Maker's Clamps

In making up pieces of furniture, for instance, gluing a table top together, gluing up a piece of panel work or anything of this kind, instead of having to buy the large and expensive cabinetmaker's clamps, I made use of three pairs of printer's quoins as shown in the sketch. Two pieces of wood are screwed to the bench or floor with ample room between them for the work, and the quoins are used in a manner similar to that in which they are used

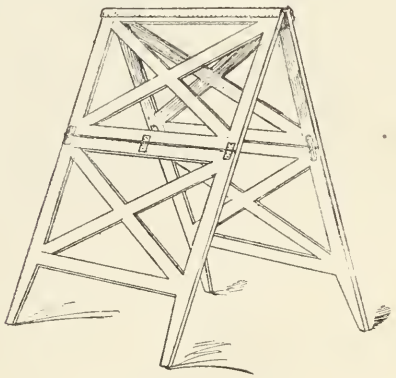


Clamping with Quoins

in the page or job press forms.—Contributed by H. M. Heyde, Houston, Texas.

Tapestry Display Rack

The show rack shown in the accompanying sketch was originally designed to be used by a traveling salesman for displaying heavy tapestry samples. It is so constructed as to fold to the trunk size and 2 in. thick, says the Upholsterer. The frame and braces are made of light wood mortised and set in so the entire rack will



Rack Ready for Use

have a smooth surface. This rack is not only a handy thing for the traveling salesman, but can be used to advantage on the salesroom floor as well.

Preventing Disturbance on Telephone Lines

By F. H. Tillotson

Explanation of Cross Talk and Other Disturbances and How They Are Overcome

As a usual thing the average telephone man will tell you that if two or more toll lines parallel one another, or if the telephone lines are in close proximity to power circuits, noise disturbances will be the result, the remedy being transpositions. But how many of these same men can explain to you why we have such disturbances or how transpositions remedy the same? The following explanation of line disturbances is offered in order that the work may be better understood.

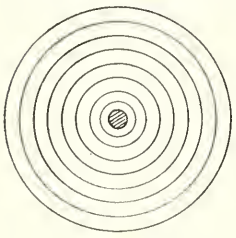


Fig. 1

Let us first consider a current flowing in a conductor. Around this conductor will be lines of force which compose the magnetic field. This is shown in Fig. 1, the conductor shown in cross section and the lines of force being closed circles. The strength of the field of force around the wire will of course depend upon the strength of the current flowing in the wire. If this current is constant and always in the same direction, then the field remains constant, but if the current is a changing one, then the field of force will change with it.

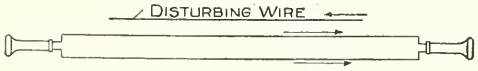


Fig. 2—Metallic Circuit

Fig. 3—Induction on Grounded Circuits

Let us suppose that a telephone circuit is so near a wire carrying a varying current as to be cut by the varying magnetic field. If the telephone circuit is metallic and both sides equidistant from the disturbing wire, and also in electrical balance, then the currents induced in each side will neutralize each other and no noise will result. Such a condition is shown in Fig. 2, the arrows showing the direction the currents flow at any given instant.

If the disturbing wire is nearer one side than the other, then the induced current in the nearest side will be the greater, hence they will not neutralize each other at the receivers and noise will result. In the case, however, of a grounded circuit, as shown in Fig. 3, you will notice there is no chance of neutralizing the effect of the induced current. It has a continuous path through both receivers to the ground, therefore a noise will be produced in both. If in any case the disturbing wire is another telephone circuit the conversation will be reproduced in the second circuit giving what is known as cross talk. This is most common in grounded lines.

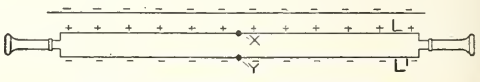


Fig. 4—Induction on Metallic Circuit

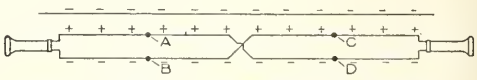


Fig. 5—Effect of Transposition on Induction

Now let us take the case of the metallic circuit in which the two sides are not equidistant from the disturbing wire as in Fig. 4. Let the side L of the circuit be nearest to the disturbing wire. At a certain instant the charge on the disturbing wire is negative. The side L will then have a positive charge and L^1 a negative charge. It has also been found that the points X and Y are neutral and if receiver is connected to them no noise will be heard. Now the positive charge on

the disturbing wire, which follows the negative charge will cause this negative charge to flow from Y to X through both receivers until L is negatively and L^1 positively charged, and so on for each change in the charge on the disturbing wire. Thus we see that as the charges on the disturbing wire vary we have alternating currents flowing through the circuit which produce noises in the receivers.

If we now transpose the lines as in Fig. 5 we will reduce the noise in the receivers but not entirely eliminate it. X and Y are no longer neutral points, as each half of each side has neutral points at A and B, and C and D. The charges now have four paths, instead of two, to the more remote portions of the circuit. Theoretically an infinite number of transpositions would be required to entirely eliminate induction,

Fig. 6—Transpositions on Two Parallel Circuits

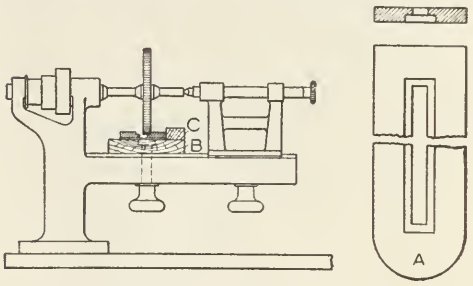
but practice has shown that in long lines transpositions at every ¼ or ½ miles are sufficient.

In making transpositions on parallel circuits care must be taken to see that such transpositions are so arranged that the circuits are always transposed against one another, thus avoiding bringing them back into the same inductive relation as at the start. For instance in two parallel circuits one should be transposed twice as often as the other as shown in Fig. 6. The use of twisted pairs of insulated wires for cables, inside wiring, and to some extent for outside work, accomplishes the transposition of circuits quite thoroughly. Every twist of the wire amounts to a complete transposition. This is the method employed in the construction of cables to overcome cross talk.

¶A good varnish for electric terminals is made of sealing wax dissolved in gasoline. To prevent brittleness add a little linseed oil.

Planing on a Lathe

The accompanying sketch shows how I rigged up my small lathe to cut a long slot in the strip of sheet brass

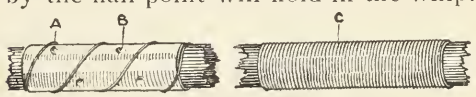


Method of Mounting the Work

shown at A, as I had a small lathe and some metal-cutting circular saws, but no planer. Removing the tool rest, I placed a pine board, B, across the ways and fastened it down with the tool rest clamping-pin. I carefully laid out the slots in the brass piece, then placed it in the proper position on the board B and fed it slowly against the rapidly revolving saw. Small strips of hard cardboard, placed under the brass strip served to regulate the depth of the cuts. In this manner I cut my slots smoothly and accurately without the aid of a planer.—Contributed by Thos. F. Williams, New Bethlehem, Pennsylvania.

How to Repair a Broken Buggy Whip

Secure a piece of tin about 2 in. long, and wide enough to reach around the whip at the place where it is broken. Roll the tin on the whip and hold it temporarily in place with a few strands of wire as shown at A in the illustration. Punch a few holes, B, in the tin with a nail, so the rough burr made by the nail point will hold in the whip.

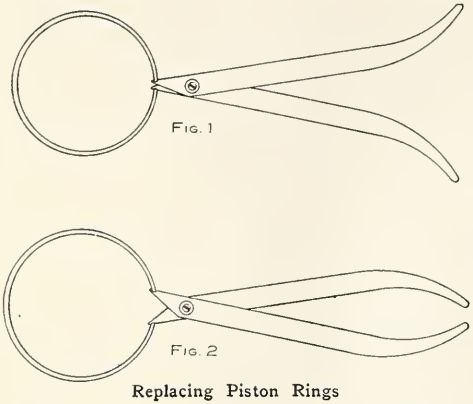


Binding the Break

Remove the wire and wind some shoemaker's thread around the tin as shown at C.—Contributed by Henry Larsen, Waupaca, Wis.

Tool for Removing Piston Rings

A very simple combination tool for the use of those manufacturing or repairing automobile and small gas engines can be made as shown herewith.



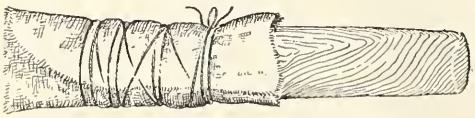
Replacing Piston Rings

The tool is made of two 1/16-in. strips of steel cut as shown in the sketch and fastened together with a screw and thumb-nut. By tightening the nut it can also be used as an inside or outside caliper. Figure 1 shows the tool in position for spreading the ring; Fig. 2, ready to slip on or off the piston.—Contributed by J. O. Brouillet, Tarrytown, N. Y.

A Substitute Paint Brush

How often does one want to paint several small articles with different colored paints and possesses only one brush, making it necessary to thoroughly clean the brush each time. I have found the following method very satisfactory:

Procure flat sticks, each about ⅛ in. thick and 8 in. long, and tie a strip of muslin, say 2 in. wide, on one end of each stick as shown in the illustration. Wind the cloth around several times,

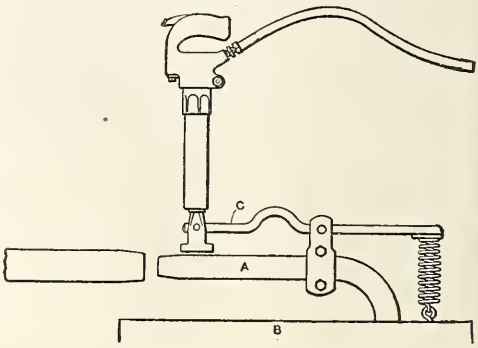


Temporary Brush Made of Cloth

tying it with thread so as to let the goods extend over the end of the stick 1 in. or more, then trim with scissors sufficient to give it the proper stiffness. This makes a fairly good brush. The broader the stick the broader the brush. The stick can be used over and over again as the brush part can be taken off and replaced with new cloth—Contributed by G. F. Orphal, New York City.

Pneumatic Flue Welder

An inexpensive flue-welding device that was designed to handle a large repair job that came in unexpectedly is shown in the accompanying illustration. It consists of a mandrel, A, which is attached to a cast-iron block, B, and a pneumatic hammer (equipped with a swage), which is mounted on a lever, C. As the illustration shows, this arm is fulcrumed to a bracket on the mandrel and is spring supported. The ends of the long pieces were first scarfed by



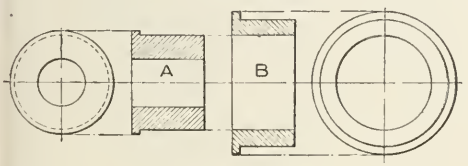
Welding Ends on Flues

lowering the back end of the tube until it was about 6 in. below the level of the mandrel. This gave a taper of approximately ¼ in. to the inch. After all the long pieces were scarfed, short pieces about 8 in. long were placed in the furnace and heated on one end so that they could be drawn to a feather edge. This was also done under the pneumatic hammer. After all the flues were scarfed and the short ends made ready for welding, the horse upon which the outer ends of the flues had rested, was raised to bring the work level with the mandrel. All short pieces were then put on the flues while hot so they would

shrink tightly in place, thus insuring a good clean weld by preventing any dirt from getting between the surfaces to be welded. After all flues were treated in this way, the furnace was cleaned, and the welding done at a speed which would make many of the costly flue-welding machines hustle to keep up.—Machinery.

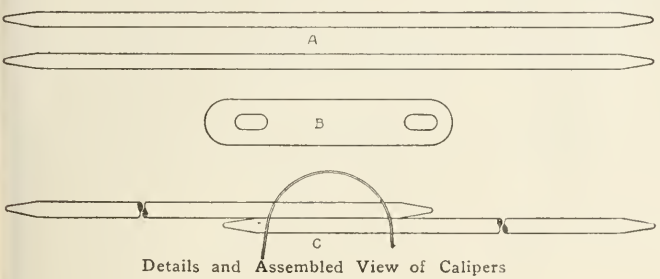
Sizing Collars for a Lathe Center-Rest

Where a great many shafts of different diameters are to be cut off in the lathe by using the center-rest, a set of collars as shown in the accompanying sketch, will prove very handy. The large one, B, is intended to be kept in the center-rest permanently. A set of small collars, A, should be made to fit the different sizes of shafting, and the outside diameter of these



Center Rest Collars

should be turned to fit the hole in the large collar. They should have a flange on them as shown, to prevent them from shoving through. Considerable time can be saved by their use as the center-rest need not be adjusted each time a different sized shaft is to be cut off.—Contributed by F. E. Randall, Pearl River, N. Y.

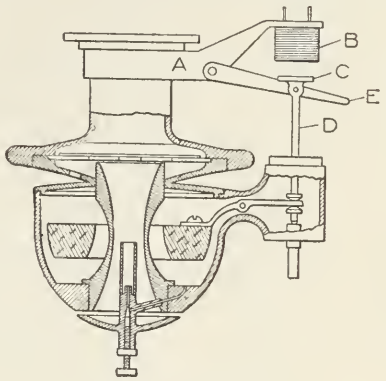


Details and Assembled View of Calipers

¶A piece of wire solder makes a good temporary spline for the draftsman.

A Magnetic Primer for Carburetors

A gasoline engine carburetor with a magnetic primer attachment is shown



Primed by Magnetism

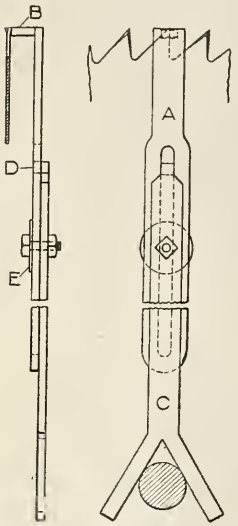
in the accompanying sketch. The supporting arm A fastens about the carburetor and holds the magnet B. When the current is applied, the plate C is drawn to the magnet, thus working the rod D. The lever E can also be worked by hand if desired.—Contributed by Leo. Beauchamp, East Hartford, Conn.

How to Make Inside Calipers for Large Work

It often happens that a machinist has use for a larger pair of inside calipers, especially on large engine and marine work, than is usually carried by the ordinary mechanic. A pair can be made in a few minutes that will do the work as well as the regular kind. Secure two ¼-in. tool steel rods of the proper length and point them as shown at A in the accompanying sketch. Then get a piece of spring steel about ¾-in. wide, 1/32-in. thick, and 4 in. long and cut ¼ by ½-in. slots in it as shown at B. When assembled as at C the caliper will be found to be adjustable, and sensitive enough for any class of work.—Contributed by J. R. Weaner, Plainfield, N. J.

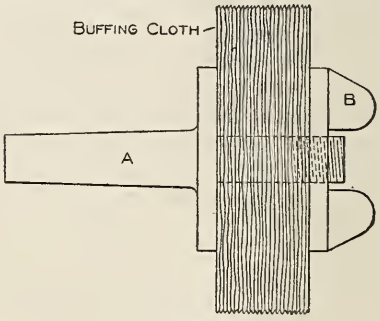
A Home-Made Circular Saw Jointer

The accompanying sketch shows the design of an adjustable circular saw jointer which will be found a very handy tool by saw filers. It can be easily made by a blacksmith out of a couple pieces of scrap iron. The dimensions can be varied to suit the size of the saws it is to be used upon, but the following size will be about right for most of them. The piece A is made of ¼ by 1-in. iron stock about 22 in. long. Split it and form a slot about ⅜ in. wide as shown in the drawing. Weld a piece of steel, B, to the top end and after it is bent temper it very hard. The piece C is of the same size stock and is about 15 in. long. It should be split at the lower end and two prongs formed, each about 4 in. long. The top is bent to form a lug, D, which slides in the slot of the piece A. A $\frac{5}{16}$-in. hole for the ¼-in. bolt should be drilled through the bar about 4 in. from the top. A washer, E, is placed under the head of the bolt to keep it from slipping through the slot. To use the tool place the forked end against the saw axle and adjust the length of the jointer to the radius of the saw. By running the teeth under the lug B the long teeth can be found and filed off.



Making a Keen Edge on Tools

The device shown in the accompanying sketch will prove handy for putting a keen edge on woodworkers' tools. It consists of a shank, A, tapered to fit in a lathe head stock spindle and a wing nut, B, threaded to screw on the opposite end of the shank as shown. Place several layers of buffing cloth on the threaded end of the shank and clamp them securely with the wing nut. Place it in the lathe center and while revolving it rapidly, apply some razorine or plater's crocus to the edge of the cloth. After tools such as gouges, chisels, etc., have been sharpened on the grindstone and rubbed slightly on an oilstone, touch them to this buffer first on one side, then on the other, and a much keener edge will be produced than could be obtained in any other way. For gouges this device is especially handy on account of their round edges. An emery-wheel spindle can be used to hold the buffing cloth if you happen to have one.—Contributed by J. C. Hansen, Chicago.



The Buffer

How to Prevent Highly Polished Metal Surfaces from Rusting

Take 1 oz. of pure beeswax and after cutting it up fine, place the pieces in a quart bottle and fill with naphtha or benzine. Cork tightly and after allowing it to stand for 24 hours or more, carefully draw off the clear solution into another bottle and it will then be ready for use. Take a small sponge and cover the article or surface you wish to protect as lightly as possible with the solution and then allow the parts coated to stand for 30 minutes or more so as to give time for the benzine to evaporate, after which polish with soft paper, clean waste or chamois skin.

Repairing a Split Water Pipe

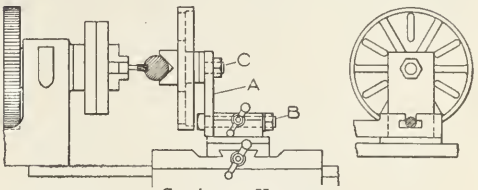
The pipe connecting my pump and well passes through the basement, and on wash day a split was found in the pipe and no water could be pumped. The split was in the pipe at a place close to the wall and in the corner of the basement where soldering it up was out of the question. An old inner tube of a bicycle was found in a woodshed and I wrapped a piece of this tightly around the pipe covering the split and for 5 in. on each side, stretching the rubber as tight as possible, then wrapped the rubber with small copper wire. The leak has given no trouble for over a year.—Contributed by L. E. U., St. Charles, Ill.

A Tool for Pulling Pipe

The pump repairman repeatedly has use for some kind of pipe pulling device. I have used various kinds, but never handled a safer and better tool than the one I designed myself. This tool I made from two pieces of 1⅛-in. square iron about 20 in. long, shaped on one end of each so as to fit around the pipe under a coupling. The other ends of the two pieces are drilled and each fitted with a clevis and both clevises connected with a link. Another link is made just large enough to slip over both pieces of iron and hold them close together on the pipe. Several sizes of links should be made to adjust the jaws to the various sizes of pipes.—Contributed by H. Toeffer, Mt. Carroll, Ill.

A Milling Attachment for a Lathe

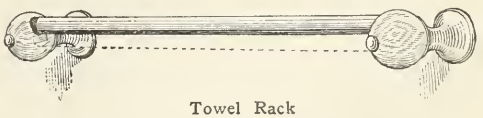
The accompanying sketch shows how I rigged up a milling attachment for my small lathe. With this device I can cut keyways in small shafting and do all sorts of light milling. I fastened a piece of steel, A, to the compound rest with a bolt, B, as large as would lay in the T-slot. I drilled a hole in this plate on the lathe spindle center-line, and into this I fastened a stud C. This stud has a shoulder which fits against the plate. Threads were cut on the opposite end to take the regular lathe faceplate which also screwed up against the shoulder. By bolting the work to the faceplate, which in turn was fastened to the compound rest as shown, and using different styles and sizes of end mills I could do a great many different kinds of milling jobs. Several adjustments could be made by changing the compound rest to different angles.—Contributed by C. L. Bryan, Corinth, Mass.



Cutting a Keyway

Home-Made Towel Rack

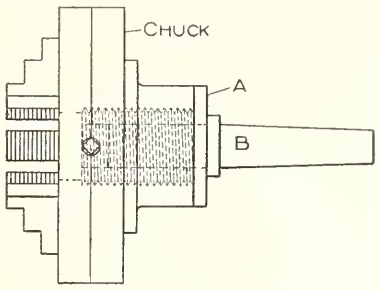
It is very convenient to have plenty of towel racks in the bathroom, but they are not often supplied on account of the first cost. Illustrated herewith is a towel rack that can be made at home and is inexpensive. The rack consists of two door stops and a round stick ½ in. in diameter. A ½-in. hole is bored in the side of each stop to receive the ends of the round stick. The holes should be bored about half way through the stop. Set the stops at the proper distance apart and turn them into the wall. The round stick is placed in the holes as shown in the illustration.—Contributed by J. C. Englehart, Richmond Hill, N. Y.


Towel Rack

¶A cocoanut may be easily broken by making two holes in the shell, extracting the milk, applying air pressure by blowing in the holes and quickly throwing it to the floor.

A Revolving Tail-Stock Chuck

The details of a revolving tail-stock chuck are shown in the accompanying sketch. The bushing A is threaded to screw into a chuck, preferably a uni-

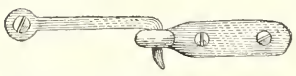


Tail-Stock Chuck

versal chuck, and is bored out to fit on a spindle, B, which has a tapered end that fits in the tail stock of a lathe in place of the ordinary center. This revolving chuck will be found a very useful lathe attachment for holding large pipes while they are being threaded or cut in two. It can be used for steadying castings while a place is being turned on them for the steady rest, preparatory to boring. It takes the place of the cone-shaped pipe center and can be used where the ordinary pipe center is useless, as it will center by either inside or outside within its limits, and it also does not require end thrust to hold it in position.—Contributed by J. N. Thomas, Burlington, Wis.

Substitute Hook Latch Staple

When putting a hook latch on a door it may be impossible to use a staple on account of danger of splitting the wood or the wood being too hard to drive a staple in without bending it out of shape. The illustration shows how to make a substitute for a staple that can be easily fastened to a door jamb without spoiling or splitting the wood. It is made of a strap of iron ½ in. wide and about 4 in. long. Draw out one end in the shape of a rod and bend it up in the



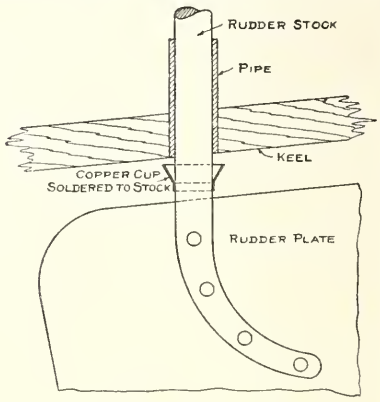
form of an eye. Drill two holes for screws. This will make it possible to fasten both hook and eye with screws. —Contributed by W. C. Parker, Kanowha, Iowa.

Thin Chilled Edges and Scale Ruin Files

A thin chilled edge with a scale on castings will ruin a new file as the strain comes wholly on a few teeth and breaks them, says Motorcycle Review This scale should be removed by pickling in a solution consisting of two parts of water to one of sulphuric acid, and the surfaces which have become chilled should be ground off before applying the file. If it is impossible or impracticable to remove the scale by pickling, an old file that has been used until it is too dull for narrow steel work may be employed; the teeth will not be broken by the hard scale.

How to Prevent Leaky Rudder Ports

A great many motorboat owners are bothered more or less by water coming



Prevents Port from Leaking

into the boat through the rudder port. It is often caused by the propeller forcing water up through the pipe when the boat is running, says a correspondent of Motor Boat. A simple, inexpensive and effective way to stop the leak is to solder a small piece of copper on the rudder post just below the rudder port as shown in the accompanying illustration.

AMATEUR MECHANICS

How to Make Paper Balloons

A paper balloon may be well made, but if it does not have the right shape it will not make a very high ascent. Balloons made spherical or designed after the regular aeronaut's hot-air balloon are the best kind to make. Those having an odd or unusual shape will not make good ascensions, and in most cases the paper will catch fire from the bottom to the top. The bottom of the gore is one-third the width of the widest point. The dimensions and shape of each gore is shown in Fig. 2.

The balloon is made up of 13 gores pasted together, using about ½-in. lap on their edges. Any good paste will do—one that is made up of flour and water well cooked will serve the purpose. If the gores have been put together right the pointed ends will close up the top entirely and the wider bottom ends will leave an opening about 20 in. in diameter. A light wood hoop having the same diameter as the opening is pasted to the bottom end of the gores. Two cross wires are fastened to the hoop as shown in Fig. 3. These are to hold the wick ball (Fig. 4) so it will hang as shown in Fig. 5. The wick ball is made by winding wicking around a wire having the ends bent into hooks as shown.

The balloon is filled with heat in a manner similar to that used with the torch and burn before they have flown very far. The following description is for making a tissue paper balloon about 6 ft. high.

The paper may be selected in several colors, and the gores cut from these pasted in alternately will produce a pretty array of colors when the balloon is on its flight. The shape of a good balloon is shown in Fig. 1. The gores for a 6-ft. balloon should be about 8 ft. long or about one-third longer than the height of the balloon. The widest part of each gore is 16 in. The widest place should be 53½ in. from the bottom end or a little over half way from

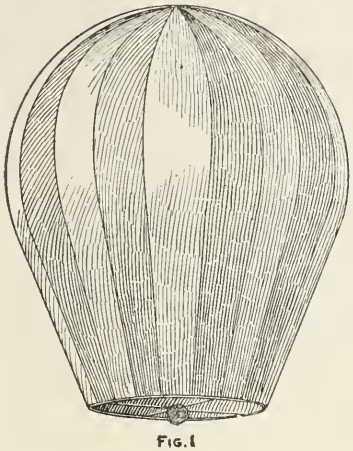


FIG. 1

Paper Balloon

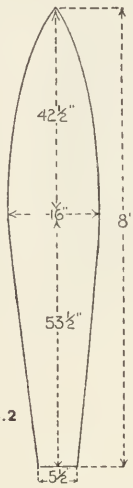


FIG. 2

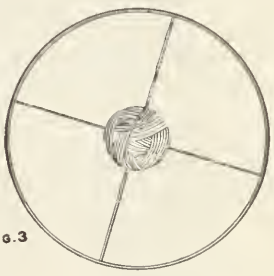


FIG. 3

FIG. 4

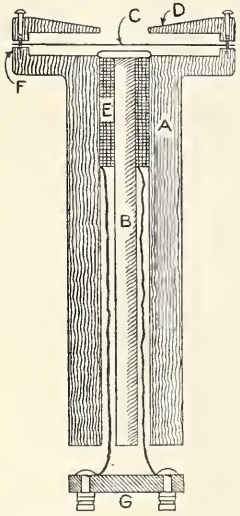
FIG. 5

Pattern and Parts to Make Balloon

ordinary cloth balloon. A small trench or fireplace is made of brick having a chimney over which the mouth of the paper balloon is placed. Use fuel that will make heat with very little smoke. Hold the balloon so it will not catch fire from the flames coming out of the chimney. Have some alcohol ready to pour on the wick ball, saturating it thoroughly. When the balloon is well filled carry it away from the fireplace, attach the wick ball to the cross wires and light it. Then let the balloon go.—Contributed by R. E. Staunton, Rochester, N. Y.

Home-Made Telephone Receiver

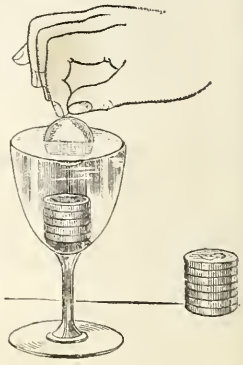
The receiver illustrated herewith is to be used in connection with the transmitter heretofore described. The body of the receiver, A, is made of a large wooden ribbon spool. One end is removed entirely, the other sawed in two on the line C and a flange, F, is cut on the wood ⅛ in. wide and $\frac{1}{16}$ in. deep. A flange of the same size is made on the end D that was sawed off, and the outside part tapered toward the hole as shown. The magnet is made of a 30-penny nail, B, cut to the length of the spool, and a coil of wire wound on the head end. The coil is 1 in. long, made up of four layers of No. 22 gauge copper magnet wire, allowing the ends to extend out about 6 in. The nail with the coil is then put in the hole of the spool as shown. The diaphragm C, which is the essential part of the instrument, should be made as carefully as possible from ferrotype tin, commonly called tintype tin. The diaphragm is placed between the flanges on the spool and the end D that was sawed off. The end piece and diaphragm are both fastened to the spool with two or three slender wood screws as shown.



A small wooden or fiber end, G, is fitted with two binding-posts which are connected to the ends of the wire left projecting from the magnet winding. The binding-posts are attached to the line and a trial given. The proper distance must be found between the diaphragm and the head of the nail. This can be accomplished by moving the nail and magnet in the hole of the spool. When the distance is found to produce the right sound, the nail and magnet can be made fast by filling the open space with melted sealing wax. The end, G, is now fastened to the end of the spool, and the receiver is ready for use.—Contributed by Austin Mettler, North Bend, Oregon.

Dropping Coins in a Glass Full of Water

Take a glass and fill it to the brim with water, taking care that the surface of the water is raised a little above the edge of the glass, but not running over. Place a number of nickels or dimes on the table near the glass and ask your spectators how many coins can be put in the water without making it overflow. No doubt the reply will be that the water will run over before two coins are dropped in. But it is possible to put in ten or twelve of them. With a great deal of care the coins may be made to fall without disturbing the water, the surface of which will become more and more convex before the water overflows.



Wood-Working Lessons for Beginners

By Ira S. Griffith

CHAPTER IV

Sawing with Handsaws

In using the handsaws the most advantageous position is obtained by placing the board which is to be sawed upon a pair of "horses" or trestles.

Whether ripping—cutting parallel to the grain—or crosscutting, the manner of starting the cut or kerf and guiding the saw throughout the operation is the same.

Figure 14 shows clearly the position of the hands when starting the kerf.

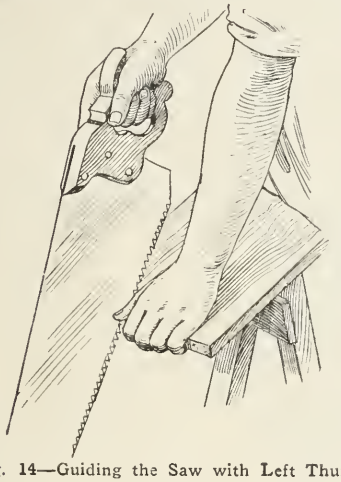


Fig. 14—Guiding the Saw with Left Thumb

The index finger of the right hand extends along the side of the handle to assist in guiding the saw. The thumb of the left hand rests upon the board at the place where the cut is to be made. With the right hand the saw blade is pressed lightly against this thumb and thus assists in setting the saw at the desired point.

Begin with short, light, easy strokes, holding up on the saw so that it shall take small "bites" at first. Gradually increase the length of the stroke until the full arm stroke is obtained. Avoid short, jerky strokes and undue pressure. Time is lost thereby, the saw cannot be properly guided, and the work is made unnecessarily laborious.

Figures 15 and 16 show the proper position to assume. The saw will cut

Fig. 15—Correct Angle of Saw

best when held at an angle of about 50 or 60 deg. with the board. Stand so as to give the arm free and easy movement, keeping the eye, hand and saw in one and the same plane, Fig. 16.

If the saw should fail to follow the line, a slight and continued twist with the hand that holds the saw handle, as the sawing proceeds, will soon cause

Fig. 16—Saw, Wrist and Elbow in One Plane

the cutting edge to work its way back to the line. This twisting must be care-

fully done or the blade will bind and kink.

When nearing the finish of a cut, lessen the length of the stroke and hold

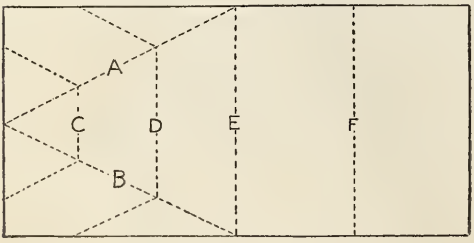
Fig. 17—Holding Overhanging Piece

up on the saw so that little weight rests upon the wood; at the same time, if crosscutting, reach over the saw and take hold of the overhanging piece, Fig. 17.

Where it is desired to cut out a small piece from a long board, always ripsaw first, then crosscut to meet this kerf, leaving on the board all but just what is wanted for present use. There are two reasons for this, first, economy; second, there is always danger of splitting off the piece when making the second cut if the crosscutting is done first.

How to Send Coins by Mail

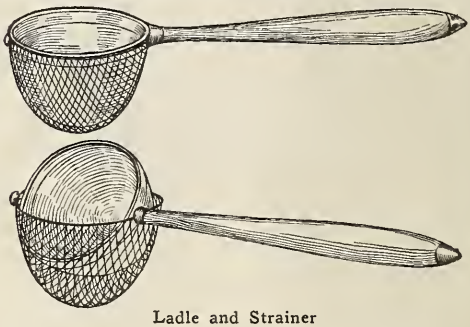
Sending coins by mail is not as a rule advisable, but sometimes it becomes necessary, and usually a regular coin mailer is not available. A very simple and secure way to wrap a coin or coins for mailing is as follows: Procure a piece of heavy paper, nearly as wide as the envelope is long, and about 12 in. long. Fold on the dotted lines shown by A and B in the sketch, and slip the coin in the pocket thus formed. Fold together on lines C, D, E and F, making the last two folds wide enough to fit snugly in the envelope. This method holds the coin in the center of the envelope where it cannot work around and cut through the edges.—Contributed by O. J. Thompson, Petersburg, Ill.



How the Paper Is Folded

Combined Ladle and Strainer

When using a strainer in connection with a ladle the operation requires both hands. A convenient article where a ladle and strainer are needed is to swing a cup-shaped strainer under the bowl of a ladle as shown in the illustration. The strainer can be held in



Ladle and Strainer

place with small bands that fit loosely over the handle, and a small tip soldered to the ladle. These will allow the ladle to be turned, leaving the strainer always in position. A large sized ladle, equipped with a strainer, is just the thing for painters to dip and strain paint, while a small one is of great assistance to the housewife for dipping and straining soups, jellies, etc.—Contributed by W. A. Jaquythe, Richmond, Cal.

¶Sheet metal placed between two boards in the jaws of a vise and clamped tightly, can be sawed easily with a hacksaw.

How to Make a Wireless Telegraph Set—Part I

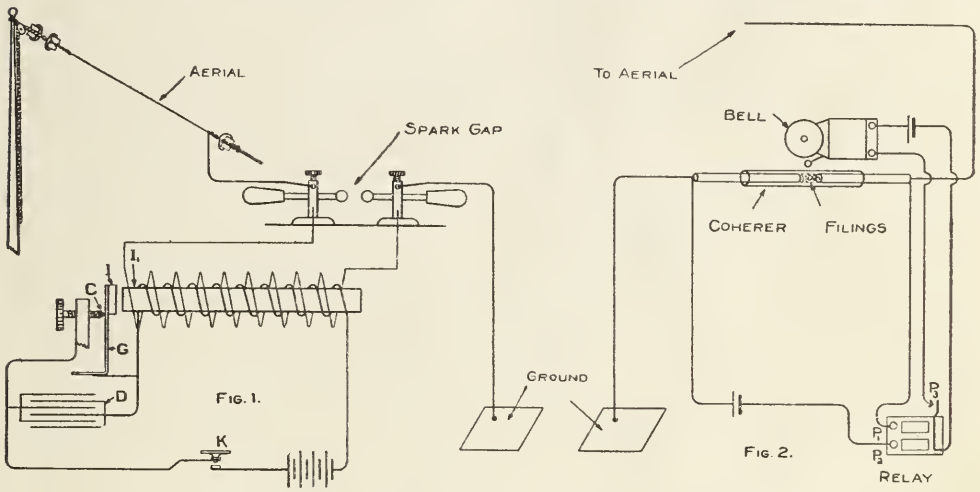
By Arthur Moore

The Necessary Parts

There is no field of electrical experimenting that has received more attention from the amateur in the last few years, than that of wireless telegraphy. A great many persons have the impression that one must be an electrical engineer in order to construct and operate successfully a wireless telegraph set. Such an impression is not well grounded. The following description of a small wireless set will not only be useful to those who wish to experiment along this particular line, but it will be a great aid in making clear the elementary principles upon which wireless telegraphy is based. A set suitable for transmitting four or five miles in the open country can be easily constructed by a boy of ordinary ability at a small cost. The information gained by constructing a small set would be a great help to those who intend building larger outfits later.

Before explaining the construction of the various parts in detail, it might be well to give a general description of them and explain their functions and operation. You will need the following parts to complete the equipment for a single station, that can both send and receive a message: A spark coil that is capable of producing a spark from 1 to 1½ in. long, telegraph key, 150 or 200-ohm relay, common vibrating electric bell, aerial conductors, coherer and spark gap.

The spark coil is used to produce a very high voltage current from a source



General Diagram of a Complete Sending and Receiving Wireless Telegraph

of electrical energy of low voltage, such as dry cells, and consists of two windings about an iron core.

The source of electrical energy is connected in series with one of these windings, which is called the "primary." The terminals of the other winding are connected to the spark gap as shown in Fig. 1. This second winding is called the "secondary." There will be produced in the secondary winding an electromotive force when there is a change of current in the primary. If the primary circuit is then made and broken by placing the telegraph key in circuit with it, there will be an electromotive force set up in the secondary for each make and break in the primary due to the operation of the key. The value of the induced electromotive force

in the secondary will depend upon the ratio of primary and secondary turns and the rapidity of the "making and breaking" of the primary circuit which can be greatly increased by placing in the circuit a current "breaker," or interrupter as it is more usually termed. The construction of the interrupter is indicated in Fig. 1. When the key, K, is closed the iron core, I_1, becomes magnetized, due to the current in the primary, and as a result attracts the iron armature, I, which is normally held away from the core by the spring G. The movement of the armature I toward the core I_1 results in the contact at C being broken and the current in the primary winding dropping to zero. The iron core loses its magnetism and the armature again returns to its normal position completing the circuit at C and again going through the same operation. With this interrupter in circuit as shown in Fig. 1, there will be a number of makes and breaks in the primary when the key is closed only for a short time and hence a much greater electromotive force set up in the secondary.

There is quite an arc formed at the contact C when the circuit is broken, due to the inductance of the primary winding. The condenser D is connected directly across the gap and reduces to a great extent the tendency for the arc to form, and as a result the decay of the primary current is a great deal more rapid, hence a greater electromotive force is set up in the secondary, and it will be continuous as long as the key is closed.

One terminal of the spark gap is well grounded and the other terminal is connected to the aerial as indicated in Fig. 1. The aerial may be made from a piece of No. 14 gauge copper wire that has one end fastened to the top of a 60 or 70-ft. pole by means of two knob insulators. One of these knobs can be tied to a rope that runs in a small pulley on the top of the pole, one end of the aerial is fastened to the other insulator or knob and the two knobs are then connected by a link of wire. The aerial should be run off at an angle to the pole to prevent them touching, and it should be well insulated where it is led into the building. If it is possible the pole carrying the aerial should be placed on the top of a building. This will give much better results. A good ground connection can be made by soldering a No. 14 gauge wire to a metal plate and burying it at a depth of 5 or 6 ft. in moist earth. The sending end is now complete. The details in construction and adjustment will be taken up later.

The coherer is the most important part of the receiving set. Branly was the first to discover that a quantity of iron filings when brought within the influence of a high frequency discharge, such as that from an induction coil or Leyden jar, will cling together, or cohere as it is termed, thus lowering the resistance of the quantity of iron filings as a whole, and a current from a battery will more easily flow through them when they are in coherence than when they are not. These filings are usually placed in a glass tube between two metal terminals. One of these terminals is connected to the aerial and the other is grounded when the station is used in receiving, as shown in Fig. 2.

A battery of low voltage and the relays are connected across the terminals of the coherer as shown in Fig. 2. The adjustment of the coherer and the relay is such that there is not sufficient current through the relay to operate it when the filings are not cohered. When, however, the coherer is acted upon by a high frequency discharge the filings will cohere, thus reducing the resistance of the relay circuit and increasing the current through the relay, which will operate it if the proper adjustment has been made.

This relay in Fig. 2 can be made to close a second local circuit consisting of a battery of a few dry cells and an ordinary vibrating bell, which serves to give an audible signal. The relay consists of two magnet coils connected in series and their outside terminals

connected to the posts P_1 and P_2, Fig. 2. There is a soft iron armature that is delicately balanced on two pivots, near the ends of the cores of these two coils. These two iron cores become sufficiently magnetized, due to a very small current in the coils to attract the armature, which is normally held away from them a very small distance by a weak coil spring. The armature closes the second circuit by coming in contact with the point P_3.

When the iron filings are once cohered they will not return to their original condition if they are removed from the influence of the high frequency discharge, and as a result the bell would continue to ring even though the coherer was not being acted upon by any discharge. To overcome this objectionable feature the filings must be decohered, which can be done by allowing the tapper of the electric bell to strike lightly against the glass tube of the coherer. The receiving station is now complete and the operation of such a set can be traced as follows: The telegraph key at the sending end is pressed, allowing a current to flow through the primary winding and start the vibrator in operation. At each make and break of the primary circuit due to the vibrator there will be a high voltage induced in the secondary which is sufficient to break down the air gap between the terminals of the spark gap and as a result a high frequency current will flow in the secondary circuit. This high frequency current oscillates up and down the aerial and is supposed to set up a similar motion in the ether existing in the air and the ground. This wave motion is sent out in all directions and any receiving station that is within its influence receives a small portion of the total energy sent out. As a result a very high frequency current flows through the coherer, thus reducing its resistance and operating the relay and closing the local circuit which starts the bell in operation. The bell will continue to ring as long as the wave continues to come in, which is determined by the time the telegraph key at the sending end is closed, and as a result the dots and dashes of the code can be easily distinguished.

(To be continued)

A Cork Extractor

The device shown in the sketch is for removing a cork or stopper from a bottle whether full or empty where the cork has been pushed inside. A wire about No. 14 gauge is bent as shown at B, Fig. 1, to fit the index finger and the other end filed to a point C, and turned in a spiral D, so the point will be on top. Insert this tool in the bottle as shown in Fig. 2 and place the end D under the cork and pull up. The cork will come out easily.—Contributed by Maurice Baudier, New Orleans, La.

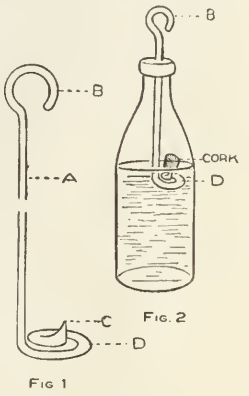
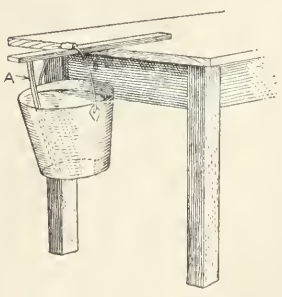


FIG. 2

FIG 1

Center of Gravity Experiment

This experiment consists of suspending a pail of water from a stick placed upon a table as shown in the accompanying sketch. In order to accomplish this experiment, which seems impossible, it is necessary to place a stick, A, of sufficient length, between the end of the stick on the table and the bottom of the pail. This makes the center of gravity somewhere near the middle of the stick on the table, thus holding the pail as shown.



How to Make and Fly a Chinese Kite

The Chinese boy is not satisfied with simply holding the end of a kite string and running up and down the block or field trying to raise a heavy paper kite with a half pound of rags for a tail. He makes a kite as light as possible without any tail which has the peculiar property of being able to move in every direction. Sometimes an expert can make one of these kites travel across the wind for several hundred feet; in fact, I have seen boys a full block apart bring their kites together and engage in a combat until one of their kites floated away with a broken string, or was punctured by the swift dives of the other, and sent to earth, a wreck.

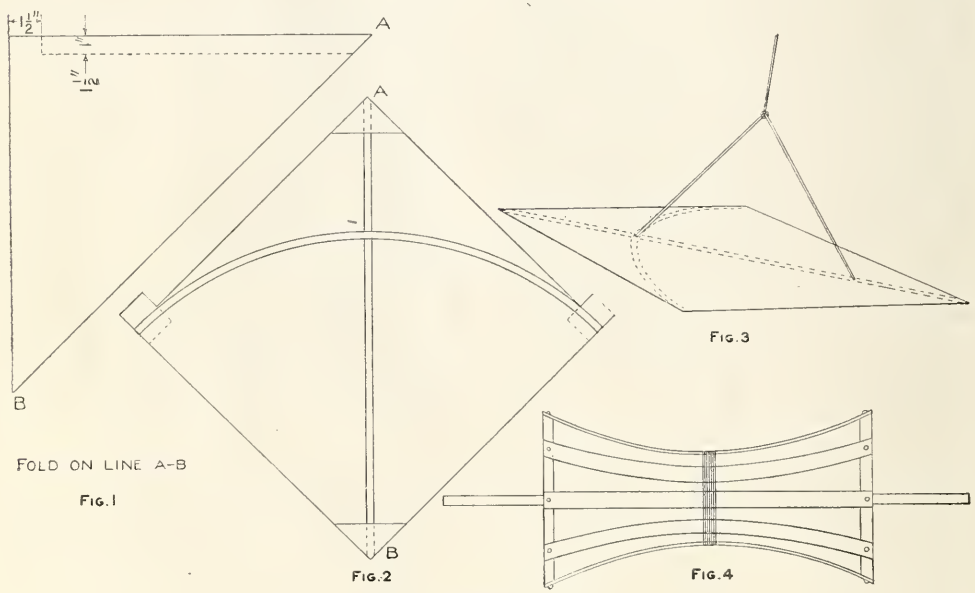


FIG. 1

FIG. 2

FIG. 3

FIG. 4

Parts of a Chinese Kite

The Chinese boy makes his kite as follows:

From a sheet of thin but tough tissue paper about 20 in. square, which he folds and cuts along the dotted line, as shown in Fig. 1, he gets a perfectly square kite having all the properties of a good flyer, light and strong. He shapes two pieces of bamboo, one for the backbone and one for the bow. The backbone is flat, ¼ by $\frac{3}{32}$ in. and 18 in. long. This he smears along one side with common boiled rice. Boiled rice is one of the best adhesives for use on paper that can be obtained and the Chinese have used it for centuries while we are just waking up to the fact that it makes fine photo paste. Having placed the backbone in position, paste two triangular pieces of paper over the ends of the stick to prevent tearing. The bow is now bent, and the lugs extending from the sides of the square paper are bent over the ends of the bow and pasted down. If the rice is quite dry or mealy it can be smeared on and will dry almost immediately, therefore no strings are needed to hold the bow bent while the paste dries.

After the sticks are in position the kite will appear as shown in Fig. 2. The dotted lines show the lugs bent over the ends of the bow and pasted down. Figure 3 shows how the band is put on and how the kite is balanced. This is the most important part and cannot be explained very well. This must be done by experimenting and it is enough to say that the kite must

balance perfectly. The string is fastened by a slip-knot to the band and moved back and forth until the kite flies properly, then it is securely fastened.

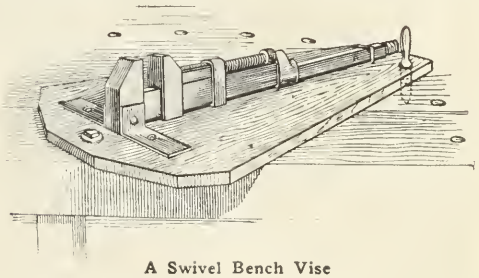
A reel is next made. Two ends—the bottoms of two small peach baskets will do—are fastened to a dowel stick or broom handle, if nothing better is at hand. These ends are placed about 14 in. apart and strips nailed between them as shown in Fig. 4, and the centers drawn in and bound with a string. The kite string used is generally a heavy packing thread. This is run through a thin flour or rice paste until it is thoroughly coated, then it is run through a quantity of crushed glass. The glass should be beaten up fine and run through a fine sieve to make it about the same as No. 2 emery. The particles should be extremely sharp and full of splinters. These particles adhere to the pasted string and when dry are so sharp that it cannot be handled without scratching the fingers, therefore the kite is flown entirely from the reel. To wind the string upon the reel, all that is necessary is to lay one end of the reel stick in the bend of the left arm and twirl the other end between the fingers of the right hand.

A Chinese boy will be flying a gaily colored little kite from the roof of a house (if it be in one of the large cities where they have flat-roofed houses) and a second boy will appear on the roof of another house perhaps 200 ft. away. Both have large reels full of string, often several hundred yards of it. The first hundred feet or so is glass-covered string, the balance common packing thread, or glass-covered string. As soon as the second boy has his kite aloft, he begins maneuvering to drive it across the wind and over to the first kite. First, he pays out a large amount of string, then as the kite wabbles to one side with its nose pointing toward the first kite, he tightens his line and commences a steady quick pull. If properly done his kite crosses over to the other and above it. The string is now payed out until the second kite is hanging over the first one's line. The wind now tends to take the second kite back to its parallel and in so doing makes a turn about the first kite's string. If the second kite is close enough, the first tries to spear him by swift dives. The second boy in the meantime is see-sawing his string and presently the first kite's string is cut and it drifts away.

It is not considered sport to haul the other fellow's kite down as might be done and therefore a very interesting battle is often witnessed when the experts clash their kites.—Contributed by S. C. Bunker, Brooklyn, N. Y.

Home-Made Vise

An ordinary monkey wrench that has been discarded is used in making this vise. The wrench is supported by two L-shaped pieces of iron, fastened with



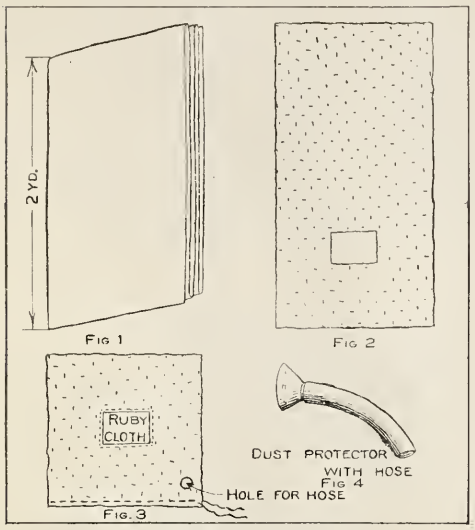
A Swivel Bench Vise

a rivet through the end jaw, and these in turn are bolted or screwed to the bench. The handle end is held down with a staple. The inside jaw is used in clamping and is operated with the thumb screw of the wrench. Two holes bored through the thumb piece will greatly facilitate setting up the jaws tightly by using a small rod in the holes as a lever.

The vise may be made into a swing vise if the wrench is mounted on a board which is swung on a bolt at one end and held with a pin at the other as shown in the illustration. Various holes bored in the bench on an arc will permit the board to be set at any angle. —Contributed by Harry S. Moody, Newburyport, Mass.

Home-Made Changing Bag for Plate Holders

A good bag for changing plates and loading plate holders and one that the operator can see well to work in can



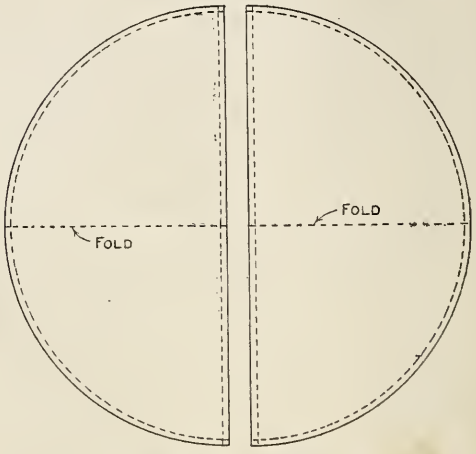
Made of Black Cambric

be made by anyone on a sewing machine. Ten yards of black cambric or other black cloth and a little ruby fabric will be required. Take the cambric and fold it into 2-yd. lengths (Fig. 1) which will make five layers of cloth, tack or fasten the layers together so they will not slip and cut an 8-in. square hole in the middle of one half (Fig. 2) and sew the ruby fabric over the opening. Be sure and make the seam light-tight and have enough layers of ruby fabric so no white light can get in. Fold the cloth up so it will be 1 yd. square (Fig. 3) and sew up the edges to make a bag with one side open. Put a drawstring in the edge of the cloth around the open side and the bag is complete ready for use.

Take the holders and plate boxes in the lap and put the bag over the head and down around the body, then draw the string up tight. A bag made up in this manner is for use only for a short time. If it is necessary to do considerable work at a time, then a dust protector, such as mill men use, must be attached to a 3-ft. length of 2-in. rubber hose and the hose run through a hole in the bag. This will make it possible to work in the bag as long as you wish.—Contributed by Earl R. Hastings, Corinth, Vt.

Home-Made Asbestos Table Pads

Asbestos table pads to prevent the marring of polished table tops from heated dishes can be easily made at home much cheaper than they can be bought. Procure a sheet of asbestos from a plumbing shop and cut it in the shape of the top of your table. If the table is round, make the pad as shown in the illustration, cutting the circular piece into quarters. Cut four pieces of canton flannel, each the size of half the table top. Two of the asbestos pieces are used to make one-half of the pad. Place the two pieces with their edges together so they will form half a circle disk and cover both sides with a piece of the flannel and pin them in place. A binding of white cotton tape is then basted around the edges to hold all the pieces together until they are stitched on a sewing machine. A line of machine stitching is made all around the outside and through the middle be-



Pads Made of Asbestos

tween where the edges of the asbestos sheets join together. This will form a hinge so the two quarters may be folded for putting away. Make the

other half circular disk in the same way. If leaves are wanted in extending the table, any number of pads can be made to cover them in the same manner with the hinge in the middle of each pad. The flannel is used with the nap side out so it will make the pad soft and noiseless. This kind of a pad furnishes perfect protection to the table from any heat or moisture.—Contributed by H. E. Wharton, Oakland, Calif.

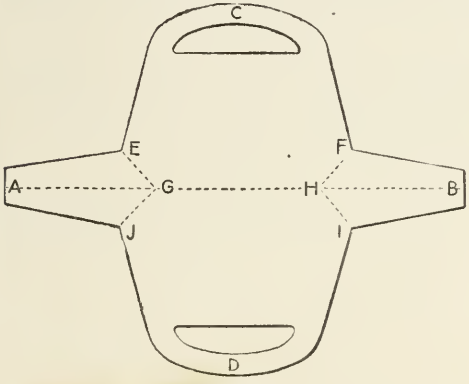
How to Make a Ladies' Handbag

To make this bag, get a piece of Russian calf modeling leather. A shade of brown is the best as it does not soil easily and does not require coloring, which spoils the leather effect.

The dimensions of the full sized bag are: from A to B, 17½ in.; from C to D, 16¼ in.; from E to F, 9¼ in.; G to H, 6¼ in., and E to G, 2¼ in.

Enlarge the accompanying pattern to the given dimensions, trace this or some other appropriate design on it, and then cut the leather the size of the pattern.

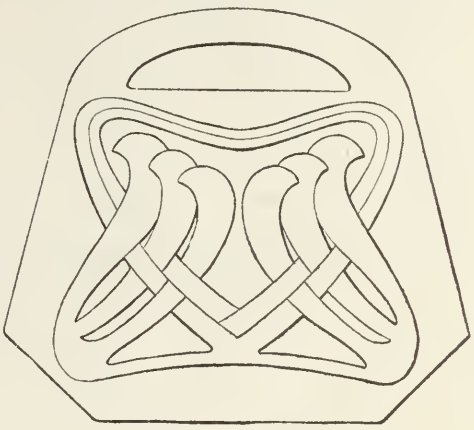
Use a sponge to dampen the leather on the rough side, not so damp that the water will come through to the right side when working, but damp enough to allow the design to be well impressed



Pattern

on the leather. Use a smooth, non-absorbent surface to lay the leather on while at work.

Now lay the pattern on the right side of the leather and with the smallest end of the leather tool or a sharp, hard pencil, trace the design carefully on the leather. Moisten the leather as

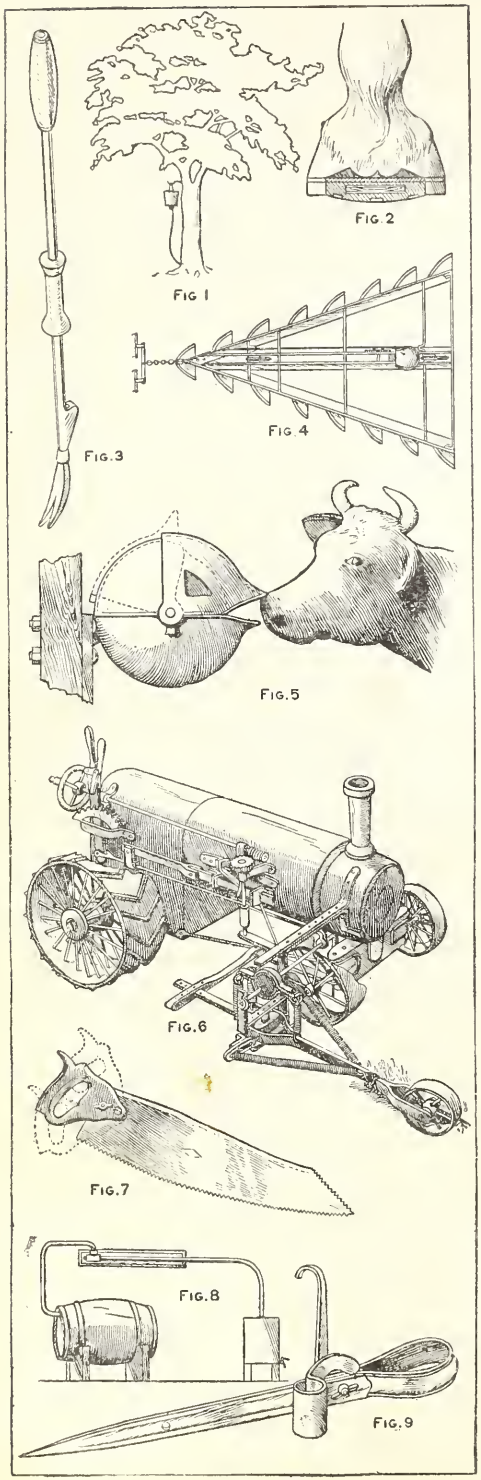

Design on the Leather

often as necessary to keep it sufficiently moist to work well. Trace the openings for the handles, also lines A-G, H-B, and E-G, G-J, and corresponding lines on the other side.

Remove pattern and trace the design directly on leather with the round point of tool, until it is made distinct and in marked contrast to the rest of the leather. Do not make sharp marks but round the edges of the lines nicely, with the rounded sides of the tools.

To complete the bag, get something with which to make a lining. A piece of oozed leather is the most satisfactory. Cut it the same size as the bag, place both together and with a leather punch, make holes all around the edge of the bag about ½ in. apart. Cut out the leather for the handle openings. Care should be taken not to cut the holes too near the edge of the bag lest the lacing pull out. Now cut narrow thongs, about ⅛ in. wide, and lace through the holes, lacing the sides of the end pieces in with the sides of the bag. Crease the lines A-G and B-H inward for ends of bag.

¶The claw of a hammer can be used for removing the insulation on copper wire, if not more than 1 in. is taken off at a time.



INTERESTING IDEAS

METHOD OF COLORING GROWING WOOD—Staining wood after it has been sawed, planed, and converted into woodwork or furniture is a most ordinary procedure, but the staining of the wood while the tree it composes is alive and growing is a departure from old methods. Figure 1 shows a device by which coloring matter is injected into the tissues of the tree in such manner that it will be distributed by the natural circulation of the sap, thus effecting a substantial change in the color of the tissues with which it comes in contact.

SPRING SHOES FOR HORSES—The growing popularity of rubber spring heels for human feet has resulted in a somewhat similar idea being adopted for horses, although in the latter instance the resiliency of the rubber heel-pad is reinforced by a spring. The rubber pad, as shown by Fig. 2, is in the form of a cross bar, with the spring in a chamber between it and the top of the shoe.

NEW TYPE OF BOX-OPENER—Figure 3 shows an improved type of packing-box opener. The force that drives the toes under the head of the nail is gained by striking downward upon the heel with the spool-shaped hammer that slides upon the shank.

BRUSH-CUTTING MACHINE—The device shown by Fig. 4 is a brush-cutter composed of a V-shaped frame, provided with outwardly projecting cutting blades. The driver occupies the seat near the back of the frame. The device cuts a swath through the brush as wide as the rear end of the frame.

SALT-FEEDING RECEPTACLE FOR STOCK—The salt receptacle shown in Fig. 5 is designed for use in a field or corral. It affords free access to the stock for obtaining the requisite amount of salt, and at the same time protects the salt from the elements and prevents waste. The opening is protected by a hood which the animal shoves open by putting his nose under it and lifting upward. When the nose is withdrawn from the opening thus made, the hood drops down again by its own weight. A sufficient opening is always left to expose the salt and attract the stock.

AUTOMATIC STEERING DEVICE FOR TRACTION ENGINES—The device attached to the front of the traction engine shown in Fig. 6 is an automatic steering device for use in plowing. It is often difficult to steer an absolutely straight course when pulling an 8 or 12-furrow series of plows behind, but the wheel of this automatic steering device makes this possible by running in the last furrow made.

NEW CUT-OUT SAW—Figure 7 illustrates a saw specially designed for cutting through flat surfaces, such as floors, without the usual preliminary boring. It can be used for cut-outs in flooring or siding, for joist or sill splicing, and in various ways as a housing saw for millwrights, plumbers, ship carpenters, etc. Its distinctive features are its double-toothed point, extra deep belly, and adjustable handle.

APPARATUS FOR RECOVERING ALCOHOL FROM THE LINING OF BARRELS—One of the departments of a liquor concern in Cincinnati is devoted to the recovering of the alcohol that has been absorbed by the wood of the barrels used for the handling of the liquid. One method of recovering the absorbed spirit is shown in Fig. 8. Under the cradle on which the barrels are placed is a pipe connected to a dry-heat radiating device. This is inserted in a hole in the under side of the barrel, and an outlet pipe in the barrel head near the top. The hot air forced into the barrel causes the alcohol to ooze from the wood in the form of vapor. This leaves the barrel through the outlet pipe, which is provided with a condenser.

MINER'S CANDLESTICK—Figure 9 is a candlestick made to meet the various demands of miners. It either may be carried by the handle, jabbed into a crack, or hung up by its hook. The hanger, when not required, can be loosened and pushed back to lie alongside the handle. The candle socket may also be set at any angle.

POPULAR MECHANICS

H. H. WINDSOR, EDITOR, 225 Washington St., CHICAGO, U. S. A.

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Contents for August, 1910

French and English Motor Searchlights.....153
Stacking Hay by Gasoline Power.....154
United States Army Tests Prove Efficiency of Dirigible.....154
Chain-Net Mail Catcher.....155
New Idea for Club Decoration.....156
Pneumatic Caisson Piers to Withstand Glaciers 157
The Kaiser's Auto Field Kitchen.....158
Steel Shed 140 by 75 ft. Moved on Scows.....158
Where a Slip Means Death.....159
Unique Life Saving Stations Along California Beach.....160
Marking the Dividing Line Between Japanese and Russian Power.....160
The Great Victor Emmanuel Monument.....161
The Curious Shape of Los Angeles.....162
Third Rail Severs Artery and Sears Ends.....162
The Power of Steam.....162
The Spread of the Boy Scout Movement.....163
Measuring Depth of Water by Sound.....170
The Packing of an Aeroplane.....170
Billions Invested in Electricity.....170
Playing Golf on a Table.....171
Ingenious Typewriter-Turntable.....171
New Resuscitation Rules Adopted by Life-Saving Service.....172
Parasites Cause Wheat Sickness.....174
The Round-Trip Flight Across the English Channel.....175
First Aerial Passenger Airship Meets Disaster in Storm.....176
The Sinking of the French Submersible "Pluviose" 176
Proposed New York to Chicago Aeroplane Trip..178
Fortification Plans for Panama Canal.....179
Skeleton of Aboriginal Hog.....179
Microscope as Kitchen Utensil.....181
English Aviator Flies to Police Court.....181
New York to Philadelphia in an Aeroplane.....182
The "Aerial Dive".....182
Propeller-Driven Automobile Makes Fast Time....184
The Infant Death Rate Among Oysters.....184
Editorial by H. H. Windsor.....185
The Violin (Poem).....186
A Record in Telephone Construction.....187
English Start for South Pole—Japan Enters Race.188
Aerial Push-Ball.....189
A Tale of the Comet.....189
Oyster Catches Mouse.....189
A Sandwich Slot-Machine.....190
Pushing a Barrel Around the World.....190
A Four-Passenger Bicycle.....190
Machine Hangs Wallpaper.....191
A Unique Place of Worship.....191
Novel Brick Sculpture.....191
Ingenious Electric Floor Scrubber.....192
The Tailor of a Battleship.....192
The Human Factor in Public Utility Regulation..193
Remains of Roman Craft Found in London.....201
The Funeral of King Edward.....202
Taking Moving Pictures on Horseback.....204
Shallow Draft Motor Gunboats.....204
Turning Huge Marble Monoliths.....205
Autos Drive Trains Out of Business.....205
Lumber Piles on Concrete Foundations.....206
Weather Balloon Kills Cow.....206
A Cheese Fair in Holland.....206
How to Make a Mission Settee.....207
Novel Potato Peeler.....208
"Resinite" to Replace Celluloid and Ivory.....208
Fire Caused by Fire Extinguisher.....209
Portable Concrete Garage.....209
Wrist-Guard for Piano Practice.....209
An Automatic Orchestra.....210
Flood Dmages in Missouri.....210
Battery Takes Electricity Direct from Heat.....210
A Novel Wood Chopper.....211
A Mechanical Steed for Training Cavalrymen.....211
Fire Ladder with Extension Legs.....212
Tons of Dynamite Explode and Shake Town.....212
Old-Time Monorail Straddled by Train.....212
Telephone Set Used in U. S. Navy.....213
Seat-Signal System for Theaters.....213
Weldless Chain from Cruciform Bars.....213
Method of Making Hollow Metal Balls.....214
The "Bargees" of the French Rivers.....214
New Automobile Accessories.....216
Sewage Disinfecting Bleaching Powder.....217
New Gas Lighting Devices.....217
Floating Cranes for Lifting Boats.....218
New Method of Stage Lighting.....218
Back-Rest for Motorcycle Saddles.....218
Motor Life-Boat Engines.....219
Steam Guards Vaults.....219
Pneumatic Paint "Brush".....219
Adjustable Motorboat Propellers.....220
How the Government Tests its Coal Purchases....220
Launching Device for Aeroplanes.....221
Motorcycle with Two-Speed Gear.....221
Pressed Steel Gears.....222
Automobile as Moving Target.....222
Workmanship Important in Concrete Making.....222
Visualizing the Activities of the Microbe.....223
Concrete Launching Ways for Lifeboats.....224
Steel Bands for Power Transmission.....225

[Continued on Page 6]

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Contents—Continued

Smokeless Frying Pan 225
A Living Tower 225
Funeral Car of Chicago City Railway 226
Safe Made Specially for Radium 226
Swindling the Poor with False Weights and Measures 227
Heavy Pianos Carried by Two Men 229
Wreck Raised by Compressed Air 229
Famous Target Hits Reproduced in Brass 229
Cheetahs Trained for the Hunt 230
The Blind as Masseurs 230
Railroad Wrecker Transplants Five-Ton Palm 231
Invalid Car on English Railroad 231
Artistic Concrete Buildings, No. 10 232
Heat, Part VII,—How to Measure 233
House of Concrete and Sewer Tile 237
Street Car Serves as Fire Engine, Snow Plow and Locomotive 237
A Woman Steamboat Captain 238
Amateur Wireless Plants as Lightning Attractors 238
Luxurious Transcontinental Cars for Horses 239
A Quaint Restaurant Sign 239
Tattooing in Bas-Relief 240
Oscar Hammerstein as an Inventor 240
The Latest Type of Baseball 240
Cantilever Stairway in Jerusalem 241
Portable Electric Sub-Stations 241
Clearing Land of Stumps in Northwest 242
To Test Hardening of Gatun Locks 242
Car for Expeditious Transportation of Fire Apparatus 243
Device for Filling a Pipe 244
Powerful English Twin-Screw Tug 244
Seven Hundred Forms of One-Length Wire 245
Curious Home-Made Auto Makes 15 Miles 245
Putting the Small Streams to Work 246
Pay-as-You-Enter Cars Operated by One Man 247
Motorcycles for Women 248
Practicing Golf with Captive Ball 248
Smallest Dolls Made in Mexico 249
A Night Fete in Monaco 250
Irrigation in Mexico 250
Jointless Cement Pipe 251
Measuring Force of Blows Struck by Burglars 251
The Problem of the Armless Venus de Milo 252
Ninety Tons of Salmon 252
An Attractive Resting Place 253
Spanish Recruits Kissing the Military Cross 253
Proposed Motor Sleigh for Extermination of Wolves 254
Immense Oil Reservoir Burns 254
Auto as Fruit-Vending Vehicle 254
A Pioneer in the Wireless Operation of Railroads 255
Detachable Express Body in Place of Tonneau 259
The Pulling Power of an Automobile 260
Costly Torpedoes Lost During Practice 260
Aeroplanes Provided with Guns 261
Riding Vehicle for Cotton Pickers 261
New Ventilation for Small Boats 261
Small, Complete Flour Mill 262
Distinctive Types of United States Navy Motorboats 262
Device Tests Taximeters 262
The Making of Arts-Crafts Lamps 263
Curious House with Door in Roof 266
A Great Salt Mine in Roumania 267
Five-Level Subway Station for New York 267
Concrete Blackboards for Schools 267
Clock-Hand Problems 268
Freight Locomotive of India 270
Accident-Preventing Devices Demanded by Italy 270

SHOP NOTES

How to Make a Reel Line Guide 271
A Chicken Feed Hopper 271
Fitting the Ends of Two Boards 271
Automatic Switch for Basement Lights 272
Keeping Paint Out of Oil Holes 272
How to Prove a Try-Square 272
Oak Stain 273
Smoker's Set for the Engine Room 273
Easy Way to Climb Poles 273
A Wedge for a Hatchet Handle 273
Clamp for Holding an Ice Cream Freezer 274
Preventing the Wear on a Cotter 274
Cost of Repainting Automobiles 274
A New Metal Tent Stake 274
Pipe-Holding Jaw for a Vise 275
Cutting Gear Teeth in Patterns on a Band Saw 275
Hot and Cold Water Mixer for Shower Baths 276
Locking a Motor Car 276
A Home-Made Jack Screw 276
How to Repair Steel Tapes 276
An Adjustable Lathe Tool Holder 277
Cutting Soil for Sodding 277
Temporary Automobile Tire Repair 277
Platform Scale Made from a Spring Scale 278
Daubing Foundry Hand Ladles 278
Aeronaut's Hot-Air Balloon—Part III—How to Descend in a Parachute 279
A Grading Level 280
Varnish on Automobile Bodies Spoiled by Washing with Soap 280
Glue Brush Holder 281
Home-Made Fireless Cooker 281
A New Type of Baseboard 282
A Temporary Repair for a Broken Lamp Glass 282
Armature Coil Puller 282
Self Feed for a Hand Drill 283
Home-Made Glass Drip Board for Sink 283
A Lifting Magnet 283
Faceplates Made of Babbitt 284
Engineers' Stethoscope 284
Handsaw Guard 285
An Adjustable Guide Pin for Profiling Pins 285
A Simple Nut Lock 285
Permanent Shrubbery and Vegetable Garden Labels 286
Tool for Turning Corner Blocks 286
A Machinists' Clamp 287
Clamp for Holding Mitered Corners 287
A Check Valve for a Drain 288
A Never-Slip Nail Punch 288
Cleaning and Care of Spark Plugs 288
Valve Timing Gauge 289
A Door Holder 289
Home-Made Window Fastener 289
Safety Collar 290
A Substitute Stop Cock 290
A Screwdriver for Headless Set Screws 290
Correct Air Pressure for Automobile Tires 290

AMATEUR MECHANICS

Spring Board for Swimmers 291
Brass Frame in Repousse 291
Finding the Horsepower of Small Motors 292
Illusion for Window Attraction 293
Cleaner for White Shoes 293
An Outdoor Gymnasium—Part I—The Horizontal Bar 294
Electrostatic Illumination 295
How to Make a Wireless Telegraph Set 296
Wood-Working for Beginners 299
A Merry-Go-Round Thriller 301

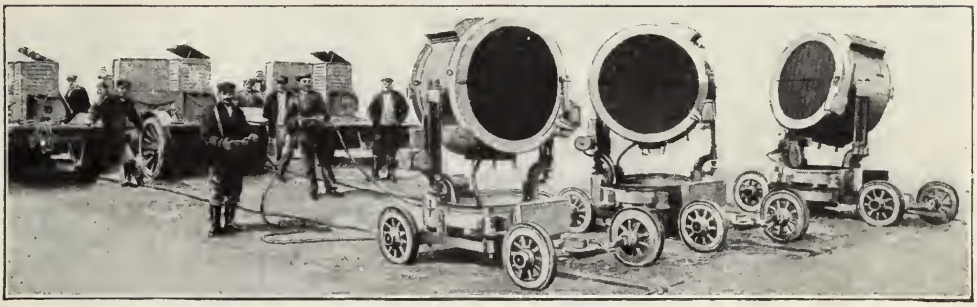
INTERESTING PATENTS, PRACTICAL AND UNIQUE

Chin Mask 302
Insect Destroying Lamp 302
Handle-Controlled Door Stop 302
An Air-Cooling Fan 302
Sanitary Tobacco Pipe 302
Rotary Hedge-Trimming Machine 302
Match Scratching Attachment for Pipes 302
Attaching Wedge 302
An Extraordinary Flying-Machine 302
Rope-Making Machine 303
Trouble-Finding Spark Gap 303
Collapsible Steel Horse 303
Spray Attachment for Dental Drills 303
Stove for Camps 303
Musical Pipe 303
Safety Hatpin 303
Carbon Remover 303
Aquatic Merry-Go-Round 303

Popular Mechanics

Written So You Can Understand It

Vol. 14 AUGUST, 1910 No. 2



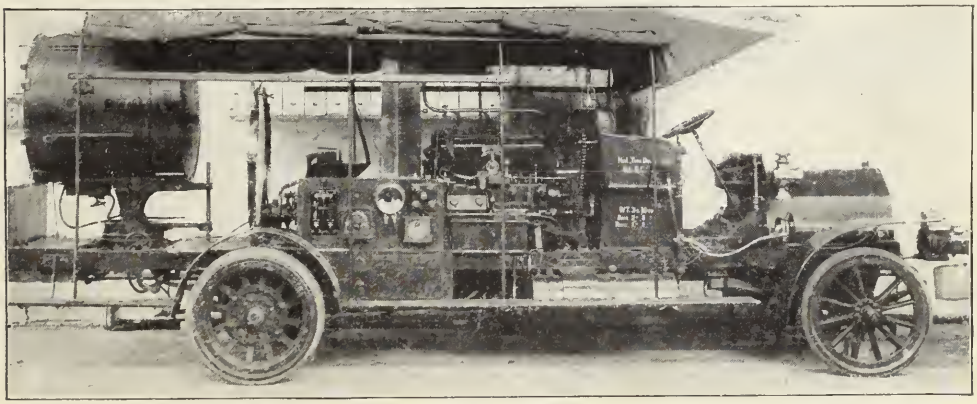
Battery of French Searchlights and Motor Trucks That Carry Them

FRENCH AND ENGLISH MOTOR SEARCHLIGHTS

Two types of powerful automobile searchlights, one used by the English army and the other by the French, are shown in these illustrations.

The French searchlights ride upon small 4-wheeled trucks of their own when in operation, but are carried on the motor-truck containing the power plant when being transported from place to place. The entire electrical outfit is behind the driver's seat, and about three-fourths of the body area to the rear of the attendant's seat is free to receive the searchlight and its truck.

The English motor searchlight is



English Motor Searchlight

unlike the French in that the searchlight proper is mounted on the motor truck itself, with a base that allows it to be swung in any direction.

Both the English and French types are expected to be of great value in times of war, as they can be quickly rushed to any point, providing the ground or roads are passable, to locate various topographical features, and spy out attempted secret movements of the enemy. Probably one of the greatest uses to which they will be put will be the searching of the heavens for aerial fighters.

UNITED STATES ARMY TESTS PROVE EFFICIENCY OF THE DIRIGIBLE

By L. W. Thavis

The army officials in charge of the signal corps of the United States army do not agree with the French war minister, who believes that the aeroplane will be more serviceable in the future than the dirigible balloon.

As a result of the recent experiments conducted at the proving grounds at Sandy Hook it was proved that it is almost impossible to hit a balloon even when it is less than 500 ft. above the ground and within easy range of the shrapnel guns. During the experiments the best gunners in the United States army were stationed at the guns and attempted to hit the balloon swaying within incredibly easy range. Yet out of a total of 90 shots fired only three hit the balloon and only one shot caused the balloon to sink to the ground. Even the shot which finally caused the great inflated bag to come down was not sufficiently effective to bring it to earth with the celerity that would prevent a dirigible balloon from getting away in time of war. The

Courtesy Gas Power

Gasoline-Driven Stacker in Operation

STACKING HAY BY GASOLINE POWER

This hay-stacking machine is operated by a gasoline engine, the hoist being mounted on one end of the engine truck. The hoist is under perfect control of the man operating the stacker, as the illustration shows, which means that one man less is required for the work. The gasoline engine, which is rated at 3 hp., furnishes ample power for operating the hoist. The hoist has a device for throwing the drum in and out of gear, and this is operated by the stacker-operator by means of lines.

other two shots were practically without any effect.

It was demonstrated to the satisfaction of the army officers in the ordnance department that it is necessary to devise a special gun and a special shell in order to destroy an airship. It is also acknowledged that an entirely different mode of marksmanship must be devised before an effective warfare can be waged against the balloon craft.

On the other hand, the officers in charge of the aeronautic division are jubilant because they think the tests have proved without question the great value of the dirigible in warfare. They point out that this type of airship can hover above a spot for hours and precipitate a regular torrent of deadly missiles upon the enemy without being in much danger from the firing of the gunners underneath.

It is believed by the army officers in Washington that the dirigible balloon, with its ability to carry great tonnage and to remain in the air for many hours, will in the end be infinitely more valuable in war than the aeroplane. It is considered practically impossible to hit a balloon in consequence of the Sandy Hook tests.

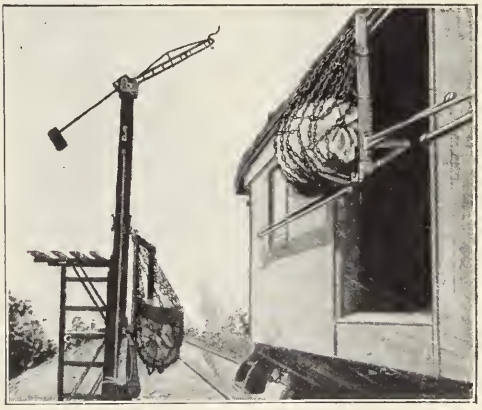
CHAIN-NET MAIL CATCHER

A new mail-catching device, which not only delivers mail bags to fast-moving trains but receives them as well, handling two or more bags as easily as one, is being installed on the Freeport division of the Illinois Central railroad.

The unique feature of the catching device is the baggy steel-chain nets, which operate in the following manner: Attached to the outside of the mail car is a square steel frame, to which the chain net is attached. This frame is made to swing on hinges attached to sliding bars so as to permit the device to be quickly shifted from one side of the car door to the other, according to the direction in which the car is moving. Attached to the lower outside corner of the frame is

Roadside and Car Device in Operative Position

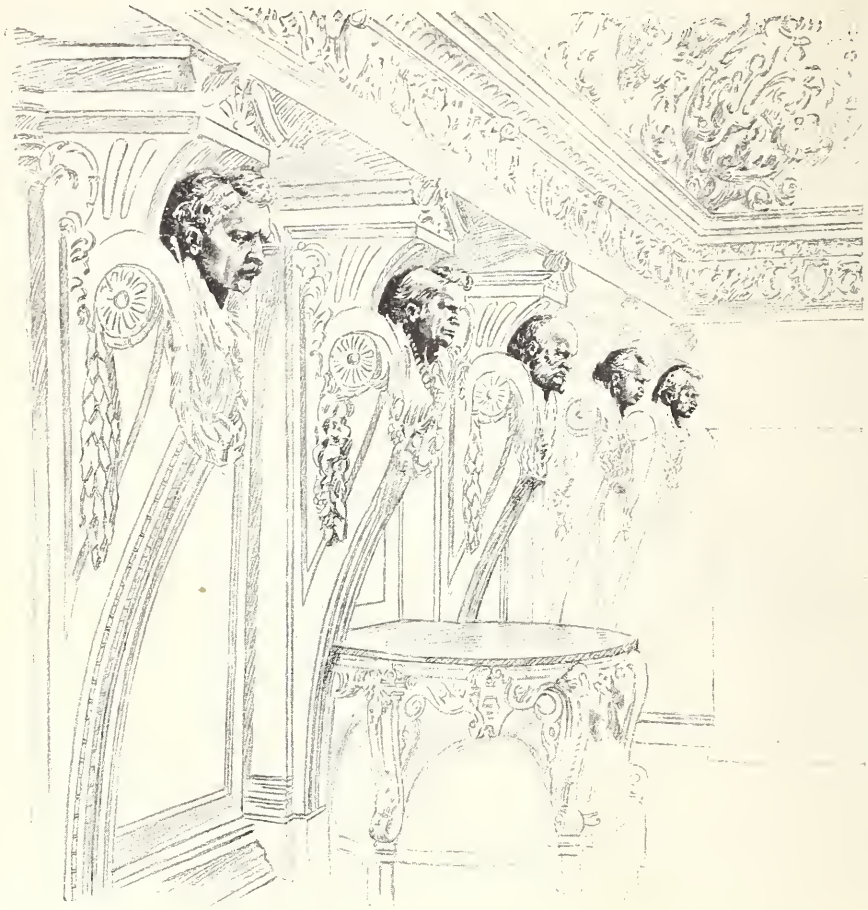
one end of an iron rod, with the other end traveling on a bar attached to the car side containing a set of spiral springs so adjusted as to bear by compression the shock resulting from the frame and net catching the mail bags. On the same outside corner of the frame, below where the rod is attached, is a hook or finger for the attachment of the bags to be delivered.



The Mail Exchanged

The roadside device, which acts in conjunction with the one attached to the side of the car, is similar in all respects, except that the bags it delivers to the train are hung above the receiving net, while with the car device the bags hang below the net.

The illustrations show clearly how the device operates. One of them shows the car approaching the roadside catcher, with two bags in posi-



Heads of Past Presidents as Club Decoration

tion to be delivered to the station, and one bag in position to be delivered to the train. The devices meet as the train rushes past, and the exchange is made, the force of impact being absorbed by the slack of the chain net and by spiral springs. The reflex action of the springs throws the frames and chain nets back as shown in the second illustration, with the mail bags surrounded by the nets.

IDEA FOR CLUB DECORATION

The gallery in the billiard-room of the new British Empire club in London has a beautiful decoration in which classic mouldings in dazzling white are the main feature in the scheme. This same idea for the reception, or any other general room, of a club, with the heads of past presidents in place of the classic heads, would provide some-

thing very new and unique in club decoration. How such a treatment would appear is shown in the accompanying drawing.

Building Great Railroad Bridge in Alaska

PNEUMATIC CAISSON PIERS TO WITHSTAND GLACIERS

The difficulties under which the engineers building the Copper River & Northwestern railway in Alaska are laboring have been mentioned before in this magazine, especially the problem of building bridges across a river discharging icebergs and huge masses of ice broken off from the 3-mile faces of the glaciers in the vicinity.

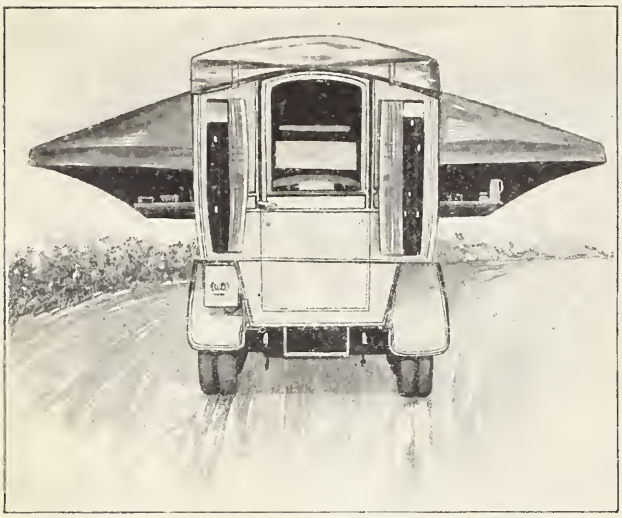
These millions of tons of ice, moving at a high velocity during flood seasons, together with the short season and severity of winter, the depth of the water, and the character of the bottom, required the utmost care in the location and design of bridge piers of exceptional stability and strength.

The piers selected are of the pneumatic caisson type, and the accompanying illustration shows the plant installed on the ice for building those of the Miles glacier bridge. This bridge is about one-fourth of a mile above the Childs glacier, and three miles below the Miles glacier. The piers are located 300 and 450 ft. apart on bars which are out of the track of the heaviest flow of ice. They are built on pneumatic caisson foundations carried down to a maximum depth of 44 ft. below low water. They have sharp cutwaters, and are heavily armored with old rails close together in vertical planes, set flush with the battered surface of the concrete, and extending from low water to above high water level. The piers, 55 ft. high, will carry the superstructure 30 ft. clear of the highest water, and are solid 6-sided masses of concrete about 64 ft. long and 21 ft. wide at the bottom, and about 13 by 45 ft. at the top.

This railroad has already been constructed 100 miles inland from the deep-water port of Cordova, on Prince William sound, and the present extension of about 100 miles more will take it in the great Alaskan copper region.

¶Several churches in different parts of Massachusetts give weekly moving-picture entertainments as a means of building up the Sunday School attendance.

THE KAISER'S AUTO FIELD KITCHEN



German Auto Field Kitchen

This rather novel-appearing automobile is the field kitchen which supplies the German Kaiser with food at the military maneuvers. In the forward section of the vehicle is an alcohol-heated stove having five openings in the top and fitted with a boiler. Underneath are two ice boxes, to one side are lockers for edibles, and on the other side are cupboards for the imperial plate. The openings shown on each side of the door in the illustration contain tables. The canopies on each side fold against the car body when not in use.

STEEL SHED 140 BY 75 FEET MOVED ON SCOWS

The reconstruction of Pier 42, North River, New York, used by the French trans-Atlantic line, necessitated the removal of a 200-ton steel shed to a new foundation on the Staten Island shore, eight miles distant. The shed is 75 ft. wide by 140 ft. long, and has a height of 45 ft.

Two 40 by 175-ft. dump-scows, 13 ft. deep, were lashed together and placed alongside the pier to receive the shed. Five floating pile-driving scows were provided to move the shed from the pier to the scows. The hoisting engines of the pile-drivers operated tackle which drew the shed from the pier. The same method of sliding ways and pile-driver power was used to pull the shed from the scows to the site of its new foundation.

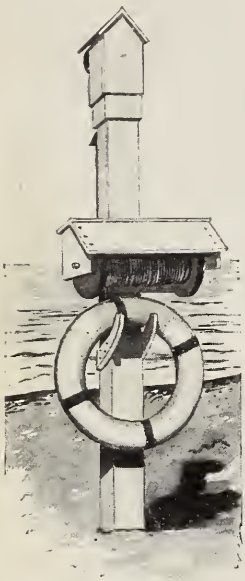
The work was executed by 20 men, and the fact that the moving was accomplished without breaking a single pane of glass in the windows, all of which were left in position, demonstrated that the system of temporary bracing which was adopted provided for all stresses.

Huge Steel Shed Transferred to Scows

WHERE A SLIP MEANS DEATH—Followers of the structural steel and iron trade, probably the most dangerous vocation in the world, working on the pinnacle of one of the new skyscrapers in lower New York.

UNIQUE LIFE-SAVING STATIONS ALONG CALIFORNIA BEACH

The illustration shows the unique life-saving stations that have been installed at intervals of two blocks all along the beach at Venice, Cal., which is the seaside resort for Los Angeles. Each station is equipped with a life buoy and life line, the latter being wound on a reel and protected from the elements, while the top of each pole is surmounted by an alarm gong. The ringing of this bell is the signal that some bather is in distress in the surf, and aid is rendered by the first swimmer to appear upon the scene who feels competent to carry the buoy and life line through the breakers. These stations have been erected by popular subscription and municipal assistance, and although established only a short time they have already been responsible for the saving of many lives. The sounding of the alarm gives notice to the volunteer life-saving corps that there is trouble and the lifeboats are quickly launched. These stations extend for a distance of two miles—from Santa Monica to Venice—protecting every foot of the bathing beach.



These Stations Have Saved Many Lives

MARKING THE DIVIDING LINE OF JAPANESE AND RUSSIAN POWER

The border line dividing the territory in Asia under Russian and under Japanese jurisdiction, over which the two countries fought one of the bloodiest wars in modern history, is marked at certain intervals by stone sentinels, in pairs. Both stones of a pair are of the same size and shape, but on one the inscriptions are in Japanese and in Russian on the other. The border line runs between the stones.

The stones are protected from damage at the hands of tourists by a heavy log fence.

Stone Sentinels of Jap-Russian Border

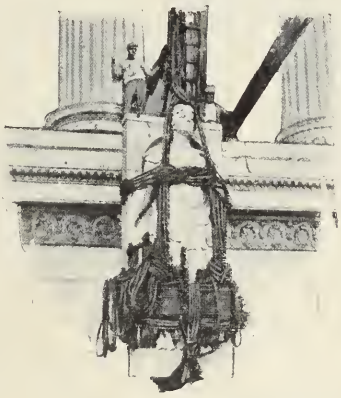
THE GREAT VICTOR EMMANUEL MONUMENT

The great memorial to Victor Emmanuel, the first king of Italy, now approaching completion in Rome, is one of the largest and most beautiful monumental undertakings carried out in modern times.

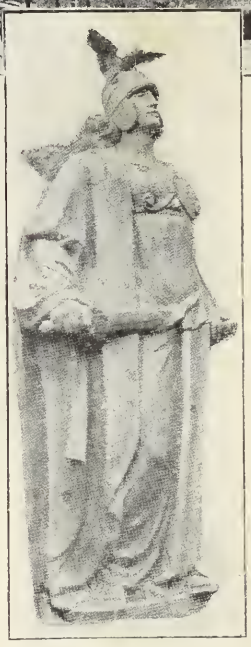
in the accompanying illustrations, are prominent in the scheme, as well as the groups of figures symbolical of Thought and Action, Sacrifice and Concord, Strength and Right, and six figures of Victory, placed on columns

The Columns of the Great Monument

Statue Representing Lombardy



Hoisting a Statue into Position



Statue Symbolic of Piedmont

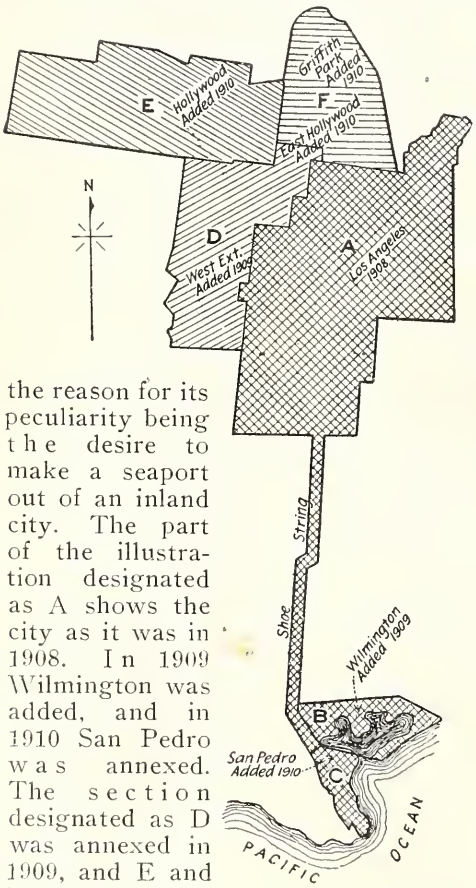
The huge equestrian statue of King Victor will be the central figure, surrounded by 14 statues representing the different personalities concerned in the welfare of Italian independence. Statues representing the different provinces of Italy, some of which are shown

The portico will have a stucco canopy composed of lime and marble, designed on much the same system as the beautiful arcades of old Roman monuments. It will be subdivided into 17 large squares, eight of which will have bas-relief figures representing the

sciences and arts. This portico is shown in the illustration, which also shows the dismantling of a small Venetian palace to clear a space before the monument. The other illustrations show statues representing the Italian provinces, one of which, that of Lazio, is being hoisted into position.

THE CURIOUS SHAPE OF LOS ANGELES

Los Angeles, Cal., claims the distinction of being one of the most curiously shaped cities in the world, the reason for its peculiarity being the desire to make a seaport out of an inland city. The part of the illustration designated as A shows the city as it was in 1908. In 1909 Wilmington was added, and in 1910 San Pedro was annexed. The section designated as D was annexed in 1909, and E and F were made parts of the city this year. The coast annexations, San Pedro and Wilmington, are connected with Los Angeles proper by the narrow strip known as the "Shoe String."



Courtesy Engineering News

THIRD RAIL SEVERS ARTERY AND SEARS ENDS

The only case on record, where a current of electricity of 550 volts strong enough to kill many men, has been instrumental in saving life, is that of Percy Cosgrove, eighteen years old, who lives at 56 Somers Street, Brooklyn, N. Y.

He was at the Chauncey street station of the elevated railroad recently awaiting a train, when he lost his balance, and fell to the tracks. His hands grasping the third rail and his thigh resting against it formed a path for the deadly current which went through his body while he lay unconscious. The flesh was burned from the bone of his leg and the femoral artery severed. The man would have bled to death but for the fact that the current after severing the artery seared it and closed it as though it had been done with a red hot iron. Trains were stopped, the current was turned off, and the young man was hurried to the hospital.

The physicians say that the case is without a parallel. Previous to the ligature of arteries, when an amputation was made the process was to sear the wound, closing the artery and stopping the flow of blood by the use of a red hot iron. In this case the current of electricity performed the same function, having exactly the same effect.

THE POWER OF STEAM

A comprehensive idea of the power of steam is given in the following paragraph taken from the "Power" magazine:

"It is estimated that a cubic foot of water under 70 lb. pressure and heated to a temperature corresponding to steam at that pressure, contains about the same energy as 1 lb. of gunpowder. Further, that a plain cylindrical boiler of average size with steam at 100 lb. pressure and filled with water to the proper level, has sufficient energy to project the boiler to a height of 3½ miles."

Sentry Duty

The Spread of the Boy Scout Movement

By FRANCIS BUZZELL

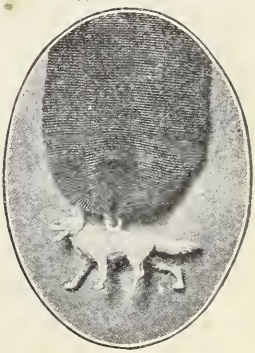
A LITTLE while before the German invasion scare had at last succeeded in scaring itself to death, the boy scout movement, destined to spread itself around the earth, was started in England. At first, because war was in the minds of the English people, the movement was thought by some to tend too much towards the encouragement of militarism, but the little opposition even then apparent was soon evaporated by the realization of the great and everlasting good the idea was bound to develop.

Militarism, in the true meaning of the word, there is not, but protection there is. And, truly, no protection is more potent than that provided by the proper development of boys. Militarism has its part to play, but the place it occupies is in that part of the boy's mind which demands some reason other than being good for good's sake to hold him steadily marching up the heights towards attainment. What means of appeal or suggestion underlying a movement for the development of lasting good is more praiseworthy then, than the idea that it is for the protection of the home in case of foreign invasion? What aims are higher for the boy than patriotism, discipline, courage, self-reliance, self-control, courtesy, thrift, helpfulness, and cheerfulness?

Every boy scout has to try hard to develop all of them, and he has a new reason for trying. The doing or leaving undone of a thing because it is or is not good never appeals strongly to the average boy, but the doing or leaving undone of a thing because it makes or mars a good scout is proving an overwhelming reason.

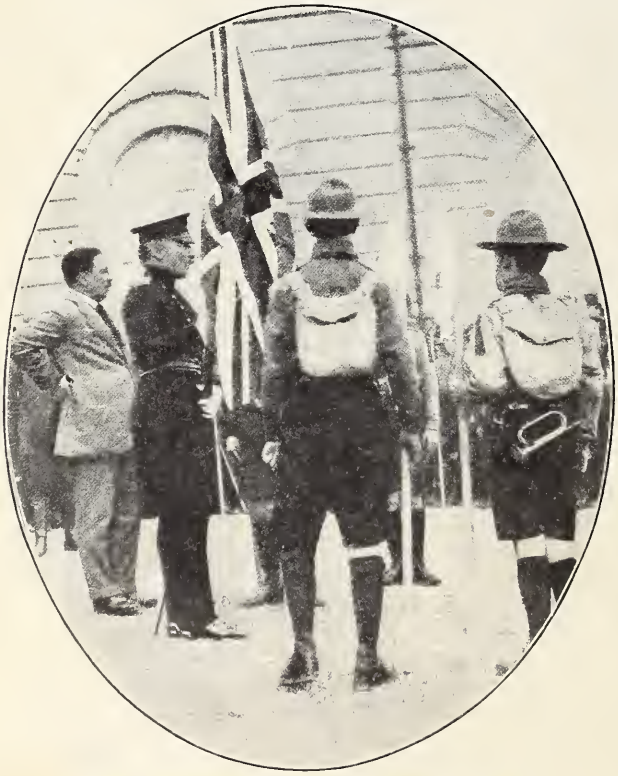
A most excellent example of this has already been provided by the manner in which the influence against smoking is taking hold. Why tell the boy it is a sin to smoke? The chances are that his father smokes, and it is not impossible that the minister smokes. Instead, the boy scout is told that the best military scouts do not smoke, because it weakens their sight, sometimes makes them shaky and nervous, spoils their noses for smelling, which is of great importance at night, and because the glow from pipes or cigars, or even the scent of tobacco might give them away to enemies.

The King's Badge
Presented to
First-Class Scouts



The Silver Wolf
Presented to
Second-Class Scouts

A Cross-Country Maneuver



Gen. Baden-Powell Presenting Scouts with Colors

For just such reasons as the above, one appealing strongly to the romantic and venturesome in the boy, and the other appealing to the desire of the parents for the boy's betterment, the movement spread until not a section or community in England is without representation. Thence it spread to the British colonies, and now bodies of men who have the welfare of the younger generation at heart have taken up the idea in the United States, and are pushing forward an organization similar to that founded in England.

Even General Sir Robert Baden-Powell, founder of the movement, and the boys' own general, had little idea of the magnitude of the popularity that would attend his efforts. Boy scouts seem to turn up at all times and at all sorts of places in England, and invariably with good re-

Boy Scouts Marching to the Rendezvous

sults. One of the accompanying illustrations depicts them actively assisting in the work of decorating the streets for King Edward's funeral. They also helped keep the streets clear, and have, on occasion, turned out to assist people through London fogs.

As the boy scout movement in America is to be patterned after that in England it is well to give a general idea of the kind of organization it is and how the boys are being developed.

The general organization, and the symbolism of the scout movement are essentially military, but the strict military discipline, and especially the routine of incessant military drill, are almost entirely lacking. General Baden-Powell, chief scout of all the boys in the British Empire, appoints scout commissioners

Gun Drill by Sea Scouts

to organize branches, inspect scout corps, and help scout masters. This work of organization is done through scout councils, composed of leading citizens of each locality, including special representatives from other local organizations, among whom are parents, school-teachers and others interested in work among boys.

The scout master is the officer in charge of a troop of two or more patrols, and must be of the age of 20 years or upwards. The patrol is the "Unit" and consists of six to eight boys under the immediate charge, while on duty, of a patrol leader, who is elected or appointed for one year.

The scout recruit is received as a tenderfoot, passes to the degree of second-class scout, and finally becomes a first-class scout. Only first-class scouts are appointed patrol leaders or scout masters.

Before a boy is received as a tenderfoot he must be, for the time being, a sailor, and must learn the principal knots. These include the square knot, the sheet bent, the clove hitch, bowline, middleman's knot, fisherman's knot, and sheep shank. Who knows but he may be called upon at any time to aid himself or another when the ability to tie the proper knot will be of the greatest assistance. Therefore, he ties and unties these knots until he can pass the examination.

While the boy is still a tenderfoot he must learn a great many things, among which are to be found the following:

If he lives in the country he must be able to track a comrade a half mile in 20 minutes. He acquires the ability to do this by practice, and to this end deer hunts are organized. One scout, as the deer, runs away in any direction he pleases. If it is not possible to track him in any other way, the deer drops a few kernels of corn or wheat occasionally for the others to follow. After giving him 20 minutes' start the hunting scouts, armed with tennis balls, or rag balls, follow until they catch up with the deer. It takes three hits to kill the deer, but if the deer gores (hits) the hunter once, he must fall out of the hunt as dead or wounded. The evening before the hunt the patrol or troop may meet in camp —which is a convenient barn, house, or tent—and the scout master may tell or read a camp yarn.

Other things the tenderfoot must be able to do before becoming a second-class scout are: to go a mile in 12 minutes at scout pace; lay and light a fire, using not more than two matches; know the points of the compass; learn and practice first aid to the injured; cook a quarter of a pound of meat and two potatoes without utensils other than his regulation "billy"; and have at least a shilling (about 25 cents in American money) in the savings bank.

Before becoming a first-class scout the boy must swim 50 yd., or, in case swimming is forbidden by the physician, must perform some other equivalent selected by the scout master. He must receive and send a message by Morse code and semaphore at a speed of at least 16 letters per minute. He must show he knows the proper means for saving life or rendering assistance in case of accident by fire, drowning, runaway, gas, or broken arm. He must bring in a tenderfoot to whom he has taught the tying of the principal knots and the scout law. He must go on foot or row a boat alone seven miles and return, and write a short report of what he saw. Finally, he must have at least four shillings (about $1.00) in the savings bank that he has earned himself.

The scout oath and the scout law are as follows:

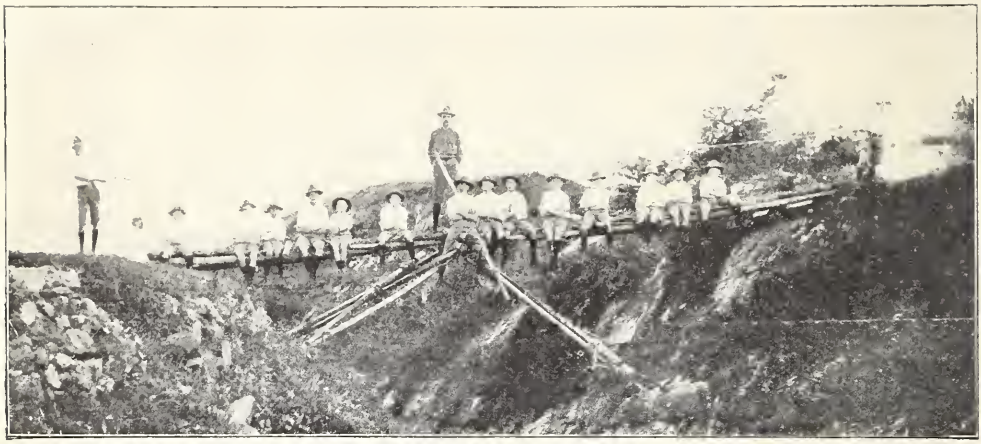
"On my honor I promise that I will do my best to do my duty to God and my country; to help other people at all times; and to obey the scout law."

Scout Law: 1—A scout's honor is to be trusted. 2—A scout is loyal to his country, to his parents, and to his employers. 3—A scout's duty is to be useful and helpful to others, and he must try to do at least one good turn to somebody every day. 4—A scout is the friend and brother to every other worthy scout, no matter to what social

Up a Tree to Find the Enemy

Stalking the Enemy in Deep Grass

Hut-Building in Camp



Military Bridge 40 Ft. Wide Constructed by Boy Scouts

class the other belongs. 5—A scout is courteous to all. 6—A scout is a friend to animals. 7—A scout obeys the orders of his parents, his teachers, his scout master, and patrol leaders. 8—A scout is thrifty, he earns and saves money so that he may not be a burden, but may help others.

A few simple lessons are outlined for military drill in the scout manual, but the drill is merely to enable the scout master to move his troop or patrol in good order, and is not an exercise for frequent practice. "When I see a troop drill well," says General Baden-Powell, "but fail to follow a trail or cook its own food, I know the scout master is not good as such."

Scouts Decorating the King's Funeral Route with Laurel

The alert scout is taught to stand erect, feet together, hands hanging naturally at the sides, fingers straight, and eyes front. Enough stave drill is provided to supply the need of exercise when an outdoor game cannot be played. There are more than 50 different outdoor games described in the scout manual, and all call for alertness, both physical and mental. Many train the eye-sight and powers of observation, and not a few train the powers of deduction. Many of the games and most of the "camp yarns" are taken bodily from history or literature. The boys, and especially the scout masters, are encouraged to read such books as "Kim," by Rudyard Kipling, "Bob the Ranger," by Herbert Strang, "Kidnapped," by Robert Louis Stevenson, "Heroes of Pioneering," by Edgar Sanderson, "Two Little Savages," by Ernest Thompson Seton, "Memoirs of Sherlock Holmes," the "Jungle Book," and "The Wild Animal Play." From these they get the inspiration for new games, and all of them carry the boys above the harmful juvenile fiction known as the "dime novel."

The older boys among the scouts practice elementary engineering, judge

distances and heights, plan roads, chop trees, or packing boxes if trees are not available, use tools, make models of bridges, make boats and rafts, study steam and gasoline engines, telegraph and telephones, and even wireless telegraphy.

The uniform is simple and inexpensive, and not positively required. It consists of a flat brimmed hat, flannel shirt, sweater if needed, knee trousers, stockings and shoes. All are of khaki color, an aid to concealment from the enemy. The shoulder knot alone is compulsory, and it consists of a simple knot of ribbon or tape of the patrol colors.

The badges worn by second and first-class scouts are obtained at cost from the general committee or council, and are awarded by the local committee upon recommendation of the scout master. The so-called secret signs consist of a salute and word of greeting.

The health is cared for by the scout in order that he may better serve his country and accomplish any scouting duty. He practices the finding of good water, and boils the drinking water if there is suspicion of taint. Tenting out in good weather is favored. It need not be for any great length of time, and may be pitched for a few days in a vacant lot in the neighborhood.

Suspicious Motorcyclist Stopped by Scouts

In the above can be clearly seen the reasons why the boy scout movement has become so popular. There is enough of militarism in it to give the boy an incentive for making his body and mind healthy and strong, and it teaches him to be helpful to himself and others. He feels that he is a man; that he is doing something for his

country. The boys of the past generation in the United States played at fighting Indians, and holding up mail coaches on the plains. They still do, although the days of the Indian and mail coaches are of the past, but the boy scout game is of a much higher order, far more fascinating for the participants, and, in place of a more or less demoralizing make-believe, is infinitely instructive.

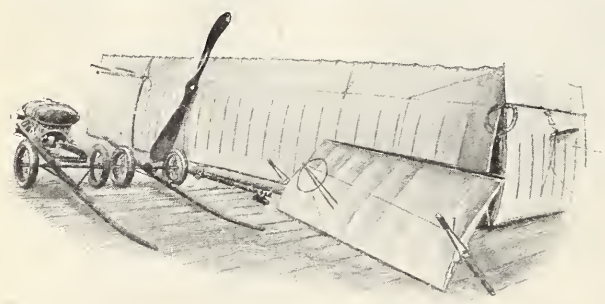
Not content with land operations in England, the scout movement has spread to the sea, and "sea scouts" have been organized.

The movement in the United States, which, of course, has nothing whatever to do with the British organization, is rapidly gaining ground. Central bodies in such cities as New York, Chicago, and San Francisco have organized to arrange details. The plan of organization and participation will be the same as that in England, but the scout unit will be ten boys instead of only six or eight. Local committees will be formed wherever desired and any ten boys may get together and form a patrol under the supervision of their local committee.

MEASURING DEPTH OF WATER BY SOUND

An electrical device whereby a sound wave is sent to the sea bottom, in relatively shallow water, and upon being deflected back to the vessel is received by another part of the same apparatus, has been designed in Norway for measuring the depth of the sea. An automatic record is made of the time elapsed between the departure and the return, and, as the velocity of sound in water is known, the depth is at once ascertained.

The apparatus makes a continuous record, and is so constructed as to give an alarm when the water shallows to a certain depth. Several tests of the apparatus are said to prove the absolute accuracy of the device.



Packing Paulhan's Aeroplane

THE PACKING OF AN AEROPLANE

The famous Farman biplane with which Paulhan made the flight from London to Manchester, winning a prize of $50,000, is shown in this illustration dismantled and partially packed for shipment.

BILLIONS INVESTED IN ELECTRICITY

According to a bulletin issued by the Department of Commerce and Labor there were, in 1907, upward of 30,000 individuals, companies, corporations, and municipalities, exclusive of isolated electric light plants, which reported the generation or utilization of electric current in commercial enterprises. These industries represent an outstanding capitalization of $6,209,746,753, of which amount $1,365,338,836 is credited to central electric stations, $3,774,722,096 to electric railways, $814,616,004 to commercial or mutual telephone companies, and $253,019,817 to telegraph companies.

¶The University of Paris has established a Chair of Aeronautics.

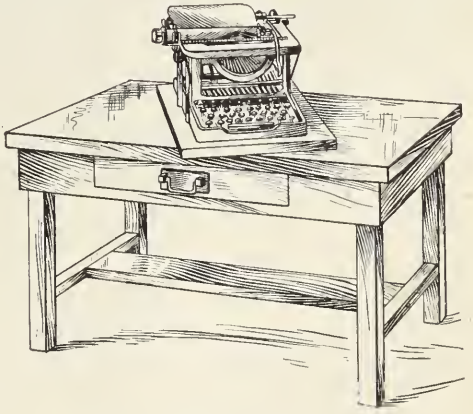
Courtesy the Sketch, London

Golf in a Dining Room

At a recent dinner at Nassau, the governing city of the Bahamas, a large banquet table was laid out in imitation of the court golf course. Miniature trees, bunkers, a lake, a bridge, and a putting green were represented. Several games were played, and prizes were given for the best approach to the hole. Miss Grey-Wilson, daughter of the governor, is shown standing on one end of the table, putting.

INGENIOUS TYPEWRITER-TURNTABLE

Two government clerks, employed in a small office having but one typewriting machine, devised an ingenious typewriter-turntable by which either could use the machine without leaving the desk chairs. The desks they occupy are in such position that they sit back to back, with 4 or 5 ft. of space intervening. In the center of this space was placed the specially constructed typewriter stand provided with a turntable. When either of them wishes to use the machine, he simply whirls about in his revolving chair, turns the typewriter into position, and sets to work. Both sides of the typewriter



Stand for Revolving Typewriter

desk are provided with drawers for stationery.

The typewriter support turns on two circular iron discs, one above and the other below the top, fastened together by a bolt.

NEW RESUSCITATION RULES ADOPTED BY LIFE-SAVING SERVICE

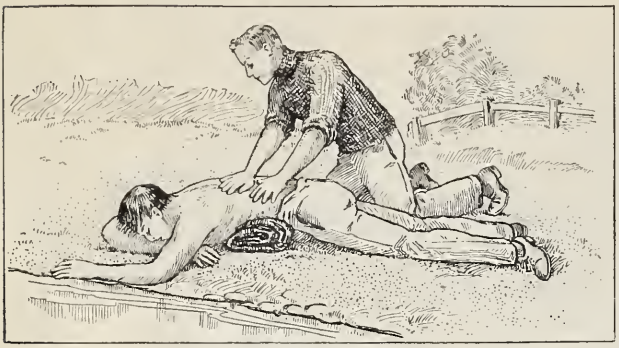


Fig. 1—Expelling Water from Body

THE United States Life-Saving Service has adopted new regulations for restoring the apparently drowned. Although the Howard method has been productive of excellent results in the practice of saving lives, the government has seen fit to combine it with the Sylvester method; the latter producing deeper inspiration, while the former effects the more complete expiration. The combination therefore of the two methods tends to produce the most rapid oxygenation of the blood—the real object to be gained. The government will urge the general public to familiarize itself with these rules that proper directions may be given in restoring the apparently drowned and thereby serve as a means of saving many lives annually.

Rule I. Arouse the Patient.—Do not move the patient unless in danger of freezing; instantly expose the face to the air, toward the wind if there be any; wipe dry the mouth and nostrils; rip the clothing so as to expose the chest and waist; give two or three quick, smarting slaps on the chest with the open hand. If the patient does not revive, proceed immediately as follows:

Rule II. To Expel Water from the Stomach and Chest (See Fig. 1).—Separate the jaws and keep them apart by placing between the teeth a cork or small bit of wood; turn the patient on his face, a large bundle of tightly rolled clothing being placed beneath the stomach; press heavily on the back over it for half a minute, or as long as fluids flow freely from the mouth.

Rule III. To Produce Breathing (See Figs. 2 and 3).—Clear the mouth and throat of mucus by introducing into the throat the corner of a handkerchief wrapped closely around the forefinger; turn the patient on the back, the roll of clothing being so placed as to raise the pit of the stomach above the level of the rest of the body. Let an assistant with a handkerchief or piece of dry cloth draw the tip of the tongue out of one corner of the mouth (which prevents the tongue from falling back and chocking the entrance of the windpipe), and keep it projecting a little beyond the lips. Let another assistant grasp the arms just below the elbows and draw them steadily upward by the sides of the patient's head

Fig. 2—Movements to Produce Inspiration

to the ground, the hands nearly meeting (which enlarges the capacity of the chest and induces inspiration)—Fig. 2. While this is being done let a third assistant take position astride the patient's hips with his elbows resting upon his own knees, his hands extended ready for action. Next, let the assistant standing at the head turn down the patient's arms to the sides of the body, the assistant holding the tongue changing hands if necessary to let the arms pass. Just before the patient's hands reach the ground, the

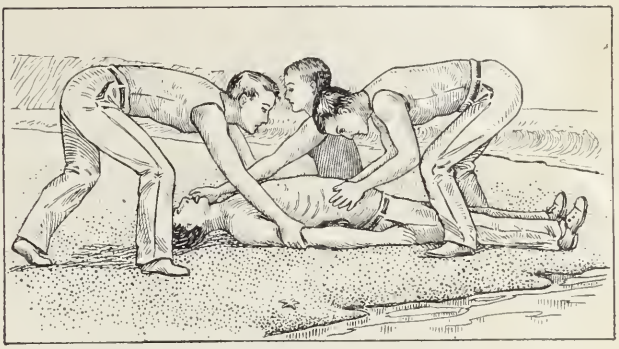


Fig. 3—Movements to Produce Expiration

Fig. 4—Movements by One Person to Produce Inspiration

man astride the body will grasp the body with his hands, the balls of the thumbs resting on either side of the pit of the stomach, the fingers falling into the grooves between the short ribs. Now, using the knees as a pivot, he will, at the moment the patient's hands touch the ground, throw (not too suddenly) all his weight forward on his hands, and at the same time squeeze the waist between them as if he wished to force anything in the chest upward out of the mouth; he will deepen the pressure while he slowly counts one, two, three, four, then suddenly let go with a final push, which will spring him to his first position. This completes expiration. At the instant of his letting go, the man at the patient's head will again draw the arms steadily upward to the sides of the patient's head as before (the assistant holding the tongue again changing hands to let the arms pass if necessary), holding them there while he slowly counts one, two, three, four. Repeat these movements deliberately and perseveringly twelve to fifteen times in every minute—thus imitating the natural motions of breathing.

If natural breathing be not restored after a trial of the bellows movement for the space of about four minutes, then turn the patient a second time on

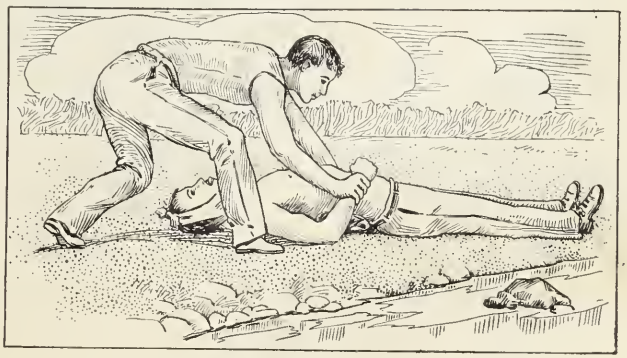


Fig. 5—Movements by One Person to Produce Expiration

the stomach, as directed in Rule II, rolling the body in the opposite direction from that in which it was first turned, for the purpose of freeing the air passage from any remaining water. Continue the artificial respiration from one to four hours, or until the patient breathes, according to Rule III; and for a while after the appearance of returning life, carefully aid the first short gasps until deepened into full breaths. Continue the drying and rubbing, which should have been unceasingly practiced from the beginning by assistants, taking care not to interfere with the means employed to produce breathing. Thus the limbs of the patient should be rubbed, always in an upward direction toward the body, with firm-grasping pressure and energy, using the bare hands, dry flannels or handkerchiefs, and continuing the friction under the blankets or over the dry clothing. The warmth of the body can also be promoted by the application of hot flannels to the stomach and armpits, bottles or bladders of hot water, heated bricks, etc., to the limbs and soles of the feet.

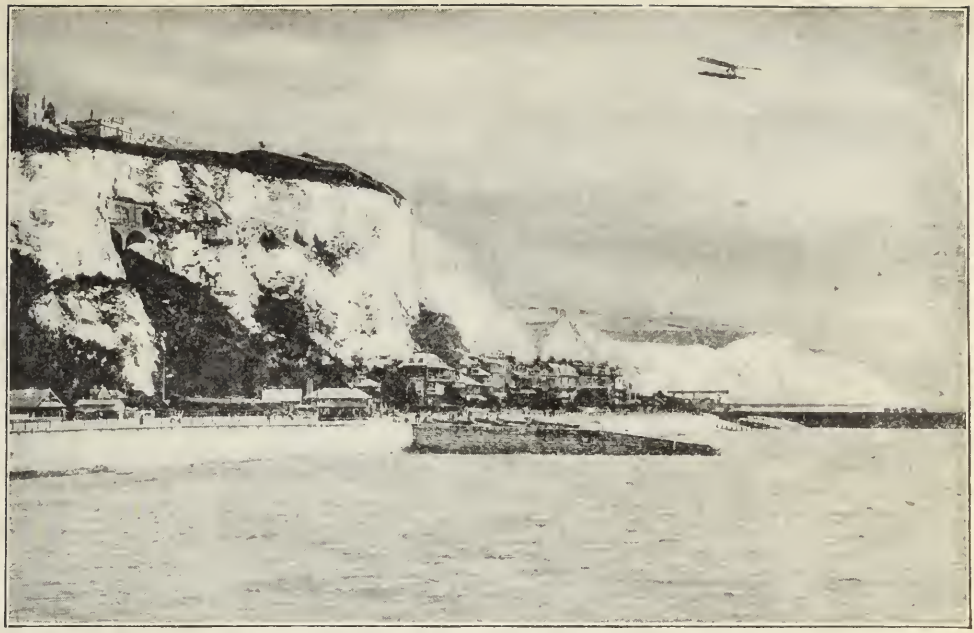
Rule IV. After-Treatment (Externally).—As soon as breathing is established let the patient be stripped of all wet clothing, wrapped in blankets only, put to bed comfortably warm, but with a free circulation of fresh air, and left to perfect rest. (Internally)—Give whisky or brandy and hot water in doses of a teaspoon to a tablespoon, according to the weight of the patient, or other stimulant at hand, every ten or fifteen minutes for the first hour, and as often thereafter as may seem expedient. (Later manifestations)—After reaction is fully established there is great danger of congestion of the lungs, and if perfect rest is not maintained for at least forty-eight hours it sometimes occurs that the patient is seized with great difficulty of breathing, and death is liable to follow unless immediate relief is afforded. In such cases apply a large mustard plaster over the breast. If the patient gasps for breath before the mustard takes effect, assist the breathing by carefully repeating the artificial respiration.

To Produce Respiration. (To be used after Rules I and II in case no assistance is at hand.)—If no assistance is at hand and one person must work alone, place the patient on his back with the shoulders slightly raised on a folded article of clothing; draw forward the tongue and keep it projecting just beyond the lips; if the lower jaw be lifted the teeth may be made to hold the tongue in place; it may be necessary to retain the tongue by passing a handkerchief under the chin and tying it over the head. Grasp the arms just below the elbows and draw them steadily upward, by the sides of the patient's head to the ground, the hands nearly meeting. (See Fig. 4.) Next lower the arms to the sides and press firmly downward and inward on the sides and in front of the chest over the lower ribs, drawing toward the patient's head. (See Fig. 5.) Repeat these movements twelve to fifteen times every minute.

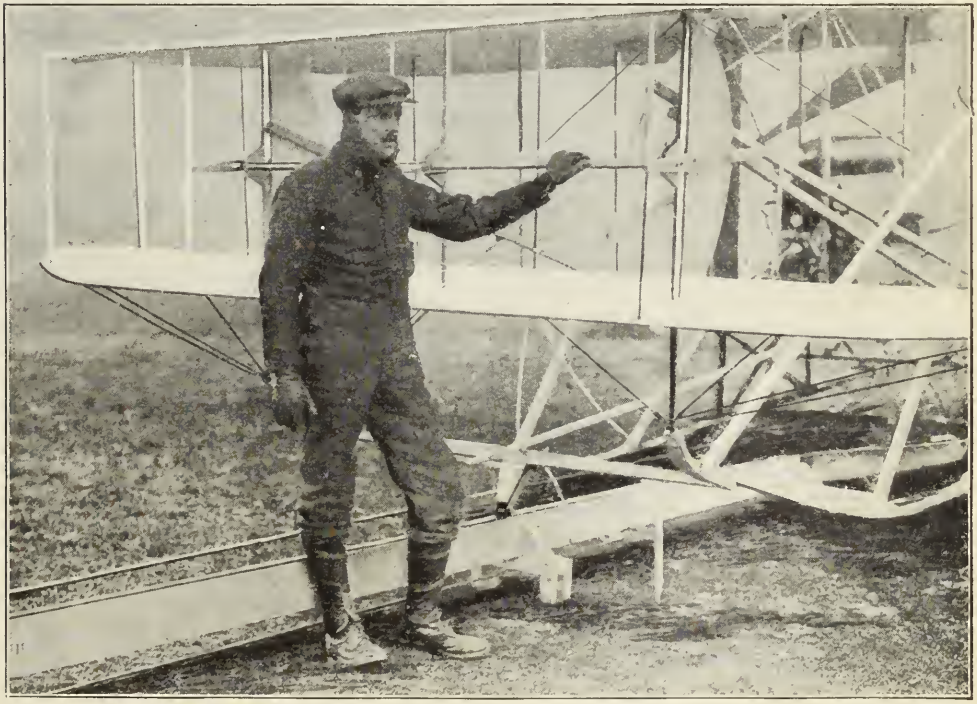
PARASITES CAUSE WHEAT SICKNESS

After 13 years of experiments, Professor H. J. Bolley of the University of North Dakota, announces that he has discovered five distinct types of parasites which cause the several varieties of wheat sickness. The fungi resemble in shape and in action on plant life the tuberculosis germs which afflict humanity. The five distinct parasites, according to Professor Bolley, came to afflict the world's soils from the same unknown cause which gave birth to the bacilli of tuberculosis. They were carried by water and wind, and especially by blown straw in threshing time, farther and farther out over the world.

The cure for wheat sickness is a proper rotation of crops, being chiefly clover, corn, and potatoes, until tests of lands show the absence of the parasitical fungi.



Nearing the White Cliffs of Dover at the End of the Flight from England to France and Return



Captain C. S. Rolls Directing Final Preparations for His Flight

THE ROUND-TRIP FLIGHT ACROSS THE ENGLISH CHANNEL

WHILE two Frenchmen, Louis Bleriot and Count de Lesseps, had crossed the English Channel in aeroplanes, it remained for an Englishman in an American machine to make a round trip. This was accomplished by Capt. Charles S. Rolls, on June 2. He used a Wright machine. The distance between Dover and Calais, France, his destination on the continent, is 21 miles, and the overwater flight of 42 miles without a stop established a new record. The flight was made in 90 minutes.

FIRST AERIAL PASSENGER AIRSHIP MEETS DISASTER

On June 22nd the "Deutschland," Count Zeppelin's latest and most powerful airship, opened a passenger service between Friederichshafen and Düsseldorf, Germany. A week later the air liner suffered the fate of several of its predecessors, and lay, crumpled and torn, a helpless wreck, on the branches of the great trees of a dense forest.

The initial trip between Friederichshafen and Düsseldorf, a distance of 300 miles, was made in nine hours, without the slightest mishap. Although buffeted about by the gale on its final trip, the airship was kept under control for a long time, Count Zeppelin on several occasions rising to great heights to avoid threatening whirlwinds. Varying accounts ascribe the disaster, respectively, to the stopping of one of the motors, to exhaustion of the gasoline supply, and to leakage of gas from the great gas bags. Thirty-three men were aboard the "Deutschland" when it was wrecked, 20 passengers, the crew of 12 men, and the builder. All escaped without injury, using rope ladders to reach the ground.

The airship was 485 ft. long and 46 ft. beam. The capacity of the gas envelope was 24,852 cu. yd. This gave it a lifting power of 44,000 lb. The motors developed 300 hp. The passenger arrangements were luxurious, the cabin resembling a sleeping-car of the finest model. It was carpeted, and the mahogany woodwork inlaid with mother of pearl.

¶In an article on a producer-gas automobile in the July issue, the following sentence, comparing the producer-gas motor vehicle with the gasoline type, appeared:

> "Gasoline costs 26 cents per gallon in Scotland, and the same load, run over the same course by a gasoline engine, would take *twenty-six* gal. of this fuel, making the total cost $2.86."

It should have read *eleven* gal. The error was a typographical one.

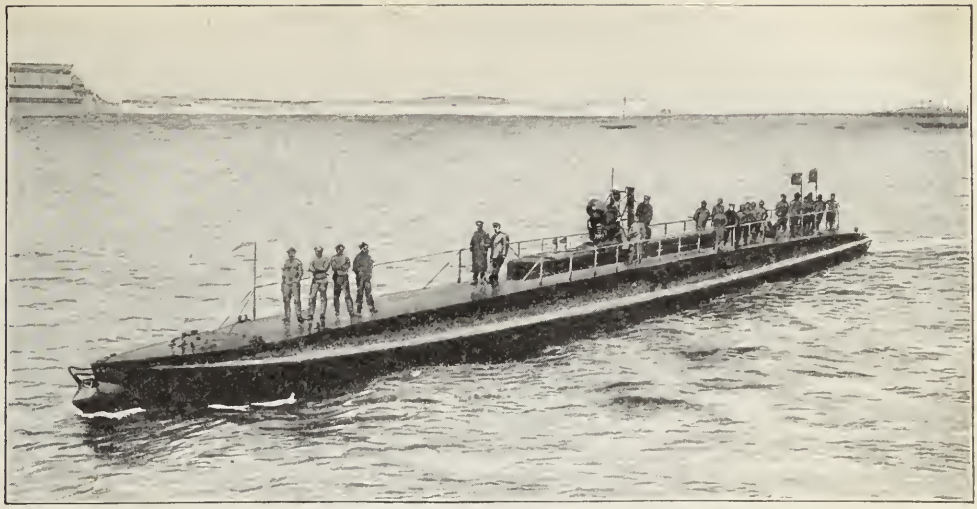
THE SINKING OF THE FRENCH SUBMERSIBLE "PLUVIOSE"

The danger incident to the operation of submarines and submersibles was emphasized recently when the French submersible, "Pluviose," was sunk in the English Channel by the steamer "Pas de Calais." The steamer was crossing the channel from Calais to Dover when it struck something in the water which the officers of the ship thought was a log. A few minutes later the bow of the injured submersible rose above the surface. For 15 minutes the bow showed above the water. A boat was lowered, but blows on the metal bow drew no response from the 26 men caged within. Suddenly the bow disappeared, the ship's boat barely escaping the vortex, and the only visible sign of the disaster was the oil floating on the surface.

Desperate efforts were made for the next two or three days to reach the doomed vessel. Divers were sent down and found her at a depth of 72 ft. Finally heavy chains were bound around the wreck, attached to large barges, and the vessel towed to the docks in this manner. The collision had torn a great hole in the hull. The death of the crew, by drowning, probably occurred during the first few minutes the bow showed above water.

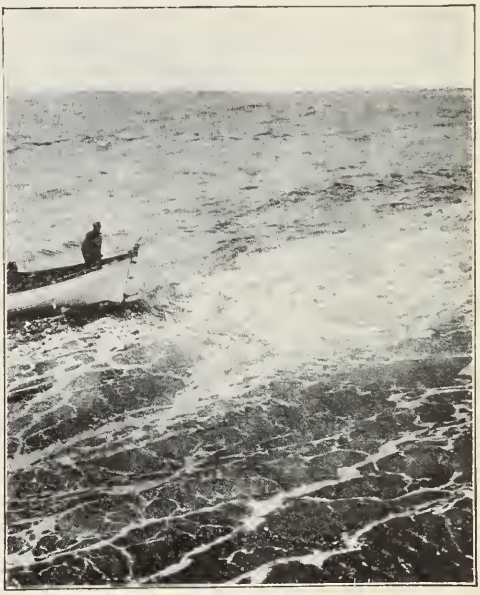
The little under-water fighters of the world navies are of two types, submersibles and submarines. The "Pluviose" was of the former. The main distinction is as follows: The submersible is a vessel which can be submerged when desired, but whose normal condition is on the surface, while the submarine is an under-water vessel, which only rises in order to take in a supply of air. Submersibles are sunk partly by the admission of water into their ballast-tanks, and then by the force of propulsion, being forced downward by diving-rudders.

In submarines the motive power is electricity, which is stored in accumulators. In submersibles there are two distinct means of propulsion—an



The Ill-Fated Submersible "Pluviose"

The Tragedy as Viewed from the Decks of the Channel Steamer



Oil Floating on Surface Above the Doomed Craft

How the Wreck Was Carried to the Docks by Barges

View Showing the Proposed Routes of

electric motor for use under water, and a gasoline or steam engine for propelling the vessel on the surface.

In war, submarines would operate near their own coast, and would protect harbors against an invading fleet. Submersibles, as sea-going vessels of the torpedo-boat type, would accompany fleets and attack the enemy's vessels.

The "Pluviose" was one of a class of 18 submersibles of the French navy. She had a displacement of 398 tons, and a maximum speed of about 14 miles above water, and 10 miles below.

¶Aviator Bleriot, while serving his term of military service recently, carried dispatches in his aeroplane from Chalons to Paris, this being the first time military dispatches were ever sent by such a means.

¶Gasoline, which flowed into the sewers from automobile garages, caused an explosion in New York recently, throwing nine iron manholes covers high into the air.

PROPOSED NEW YORK TO CHICAGO AEROPLANE TRIP

The enthusiasm engendered by the flight from London to Manchester by Paulhan, the round trip over the English Channel by Captain Rolls, the Albany to New York flight by Curtiss and the round trip from New York to Philadelphia and back by Hamilton, have created a widespread faith in the ability of aeroplanes to negotiate still longer flights, and encouraged aviators to greater effort.

A number of long-distance flights have been proposed, large prizes having already been offered. The three principal events tentatively scheduled are from New York to Chicago, New York to St. Louis, and New York to Washington. It is not thought that any of these flights will be attempted before the fall. A committee is now working out rules to govern the New York to Chicago flight. This committee will settle upon the number of stops to be allowed and the exact route.

Contemplated Long-Distance Aeroplane Flights

FORTIFICATION PLANS FOR PANAMA CANAL

Although details are still lacking and many changes will undoubtedly be made, the plans for the fortification of the Panama canal, it is said, will call for defences upon three small islands off the coast on the Pacific side, and a fort on the Pacific mainland. At the Atlantic end of the canal there will be two forts on the mainland on either side of the mouth of the canal. The armament of the forts, as at present contemplated, will be 14-in. disappearing guns, mortars, and secondary batteries of 6-in. quick-firing guns.

The forts are to be manned by the coast artillery corps, reinforced by a garrison of some 4,000 men of all arms, to be stationed in barracks at different points upon the higher ground of the Isthmus.

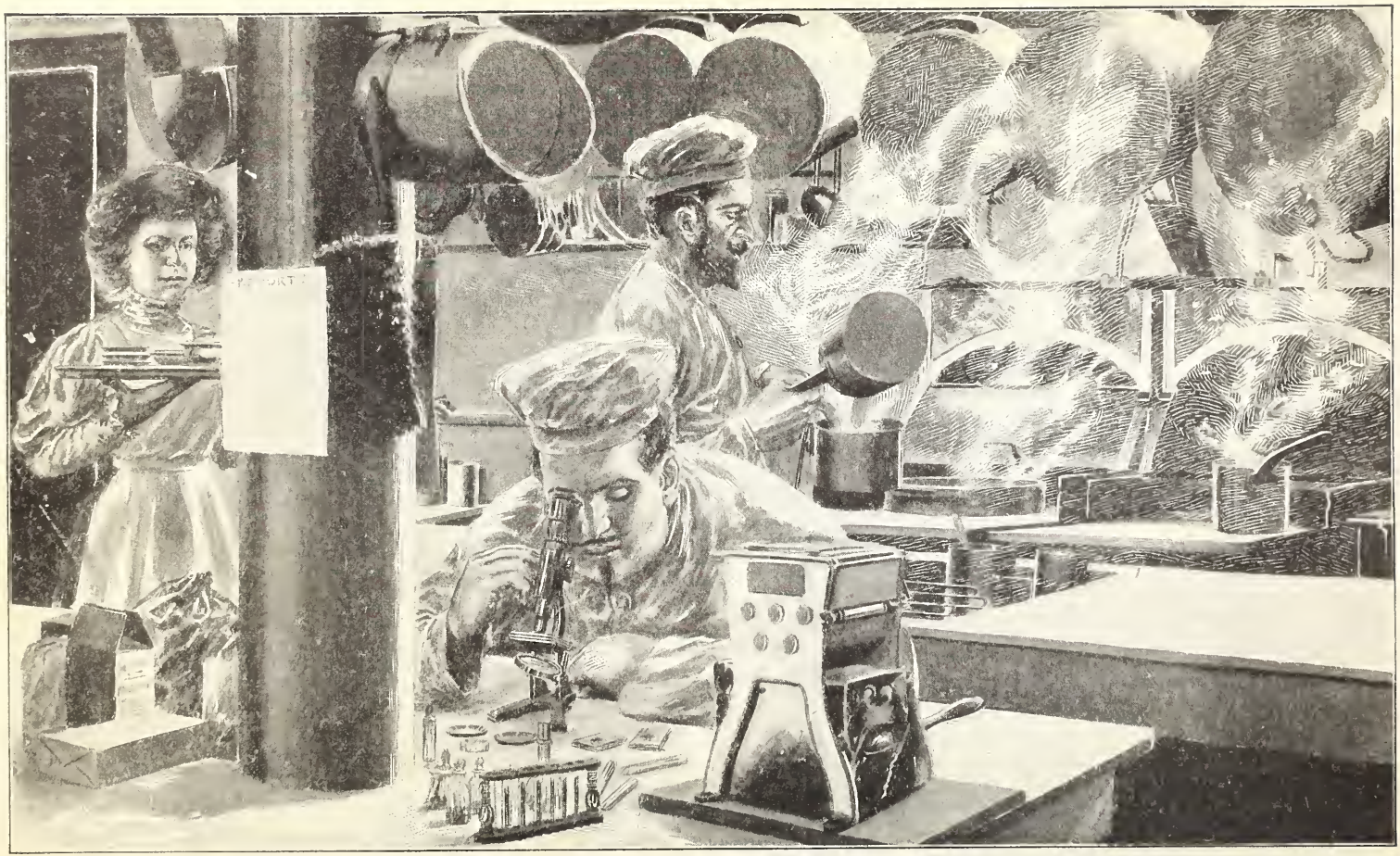
The mortars may be of a different pattern than those hitherto used in American coast defense. The present weapon throws a projectile weighing 1,000 lb., and has an effective range of 10,000 yd., while the contemplated weapon will only throw a projectile weighing 700 lb., but having an effective range of 17,000 yd.

SKELETON OF ABORIGINAL HOG

A huge skeleton which the zoologists of the Nebraska University declare to be the skeleton of an aboriginal hog has been found embedded in sandstone in northwestern Nebraska. Possibly 100,000 years ago, or it may have been several hundred thousand years, the great animal existed.

If the conclusions of the zoologists are right this prehistoric hog weighed in the neighborhood of 6,000 lb., stood 10 ft. high at the shoulders, and had tusks like the horns of a Texas steer.

¶According to the Far Eastern Review, China has ordered two cruisers, two coast defense vessels, two dispatch boats, six torpedo destroyers and four torpedo boats. These will be the nucleus of the new Chinese Navy.



The Head Chef of the Future Submitting Food to a Microscopic Analysis

Microscope as Kitchen Utensil

The food experts of the Department of Agriculture recommend a powerful microscope as a necessary kitchen utensil for large establishments. The use of such an instrument in detecting adulteration in various common food products requires some amount of knowledge, but this is readily gained with a little experience. The characteristics of the different starch products, for instance, under a microscope with a magnifying power ranging from 50 to 400 diameters are easily learned.

"To the naked eye all these starches appear as a fine white powder," says the bureau of chemistry, "but under the microscope, grains or granules are seen which vary more or less in shape, size, rings, etc. In the case of potato starch, for example, the grains are large, with smooth outlines, while rice starch has small grains with angular outlines. Potato starch adulterated with cornstarch can be easily detected, as the grains of the latter have an angular form. In the case of spices, most of the substances used for adulteration have a structure very different from the genuine articles. Although pepper adulterated with ground peas or beans may not always be detected, even by means of the chemical test of the expert, especially when olive pits or pepper shells have been added to counteract the excess of starch present in the peas, the microscope will reveal such adulteration at once by showing the presence of large starch grains characteristic of certain legumes.

"The microscope is also a thoroughly efficient detector of adulteration of coffee and chocolate preparations. In the former, roasted chicory, cereals, and peas, and in the lattter, starchy material and cocoa shells, are sometimes used. Coffee, being the seed of a plant, has a structure which is very different from chicory, which is a root. The cell walls of coffee have a beaded appearance which is present in but few other seeds. Even after roasting and grinding, these beads can be easily distinguished, while chicory contains sap vessels which can be just as easily detected.

"Artificial jellies, jams and some kinds of confections are often thickened with gelatine, starch, gum tragacanth, and gum arabic. A thickener of cream often used is a substance composed of cornstarch and gum tragacanth. The cornstarch, under the microscope, appears as the angular particles, while the streaky substances near the center of the field are swollen fragments of the gum."

ENGLISH AVIATOR FLIES TO POLICE COURT

Claude Grahame White, Paulhan's famous rival in the London-Manchester flight, was summoned a short time ago to appear in court for exceeding the 20-mile speed limit in his automobile. When the summons was served he conceived the idea of aeroplaning from Brooklands to the police court, and, accordingly, on the day he was to appear, started through the air, where no speed laws have yet been enforced.

Leaving Brooklands at 6.30 a. m., the aviator made a 6-mile flight in 8 minutes, passing over Woking, the place in which the court was held, and landing in a field just beyond. He flew over Woking at a height of less than 100 ft., his appearance causing great excitement. He waited some time at court before his case came up, and then pleaded guilty.

During the hours he was away from his machine, which was left in charge of a mechanic, the farmer who owned the meadow in which the aviator had alighted charged sixpence per head for admission, and this fee was willingly paid by nearly 2,000 people. His profit, therefore, was something more than $200 in American money.

¶A New York hotel has installed scales in all the larger suites.

NEW YORK TO PHILADELPHIA IN AN AEROPLANE

Flying on a schedule as "Extra No. 1," and reported all along the route by railroad dispatchers of the Pennsylvania road, Charles K Hamilton, one of the foremost of American aviators, made a flight from Governor's Island, New York harbor, to Philadelphia and return on June 13th, rivaling the feat accomplished by Glenn H. Curtiss a few weeks previously, when that air pilot made a sensational flight from Albany to New York, following the course of the Hudson river.

CHARLES K. HAMILTON

Note worn condition of sleeves of leather coat near shoulders. This is caused by steel crotch on Curtiss machines which sets closely on either side of operator. The sidewise swinging of the body in this crotch controls the operation of the ailerons which govern the lateral balance.

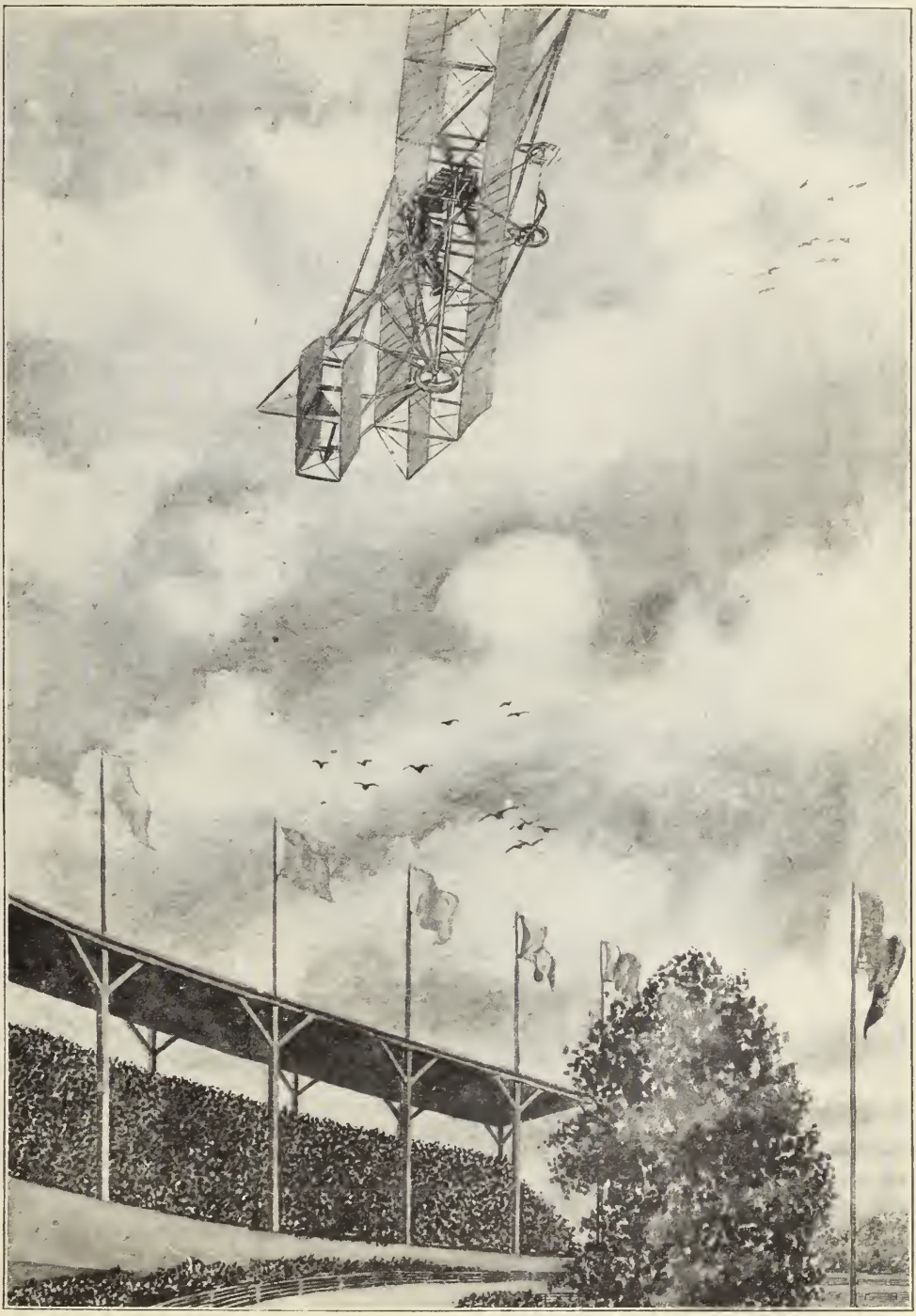
It was the first round trip ever undertaken by an aeroplane between two large centers of population. The distance traveled was 175 miles. Hamilton was in the air 3 hours and 34 minutes. He flew from New York to Philadelphia in 1 hour and 50 minutes. His average speed on the trips to the Quaker City was 46.92 miles per hour, but returning he averaged 51.36 miles per hour. He used a Curtiss biplane.

The flight was aided by favorable weather conditions, and the only interruption was caused by the sooting of spark plugs in the motor. This necessitated his descent at South Amboy, N. J., on the return trip. In making the landing at that point one of the blades of his propeller was splintered. A new one was sent out from New York, the spark plugs were cleaned, and the flight continued back to Governor's Island.

"THE AERIAL DIVE"

Not content with the ordinary dangers of aerial flight, a few intrepid aviators, among whom are an American, a Frenchman and an Englishman, have thrilled vast crowds by performing the "aerial dive." This is a "thriller" infinitely more hair-raising than anything of the high dive or automobile loop-the-loop kind of acts ever seen in a circus, and consists of flying to a great height, stopping the engine, reversing the direction of the elevating plane, and shooting downward at a high speed.

The first real "aerial dive" executed by an American was by Hamilton, at Mineola, L. I., in June. Rising to a height of 1,000 ft., and without even stopping his engine, as do the English and French aviators, he pointed his horizontal rudder almost straight to earth, and shot downward. Just when



A Feat That Makes the Circus Thriller Look Tame

the spectators were beginning to think they would witness a tragedy, he elevated the rudder, and soared away, missing the ground by less than 50 ft.

To the spectators watching Paulhan and Bartram Dickson, the French and English aerial divers, it appeared as though the men were dropping to destruction, but just before reaching the ground they dexterously righted their machines and alighted safely. The trick, however, with the engine stopped, might be considered slightly less thrilling than Hamilton's feat with the engine working.

Thousands of English and French have gone to the recent aviation meetings in the two countries for the special purpose of seeing the aerial dive. This is, of course, due to the ever existing desire for sensation, and it is interesting to note that the demand for such feats is one of the things that shows the great advance in aerial navigation. At first, simple flying was in itself sufficiently wonderful and dangerous to be sensational. But, through great advance in the science, the ordinary flight is losing its danger, and has become so commonplace that the seeker of sensation demands something more thrilling.

Made 53 Miles an Hour

PROPELLER-DRIVEN AUTOMOBILE MAKES FAST TIME

An average speed of 53 miles an hour was developed by this vehicle, a combination of automobile and airship. It was tried out on the Indianapolis motor speedway recently. The propeller was driven by a shaft connected with the drive shaft of the automobile by a link belt. The drive shaft was not connected with the differential. The propeller was made of wood and was 8 ft. long.

THE INFANT DEATH RATE AMONG OYSTERS

A scientific investigator of oyster life, referring to the enormous output of eggs compared with the ultimate crop of oysters returned, says that only one oyster may be expected to reach maturity out of every 5,000,000 eggs produced. It is very lucky indeed to escape its enemies or unfavorable conditions which may kill it in the period of five to seven years required to reach the adult stage.

EDITORIAL

THE loss of the French torpedo boat, "Pluviose," was made the occasion of expressions of the most friendly character by the press of Europe, especially that of England. Naval authorities are unanimous in the conviction that the disaster confirms an opinion which has been quite general—that the submarine must be considered an auxiliary to larger craft, and not as an independent unit. One prominent official phrased it thus: "The submarine must have a battleship as its wet nurse."

The accident also emphasizes the truth that the submarine offers the most dangerous work known to army or naval undertakings, not excepting dirigibles and aeroplanes. Notwithstanding the fact that the "Pluviose" did not sink for fully fifteen minutes after she was struck, the crew were unable to escape by the means provided for just such an emergency. This forces the conviction that naval constructors have practically failed in their efforts to furnish any dependable means of escape.

No invention has ever occasioned so much real anxiety as the submarine, the chief reason for which is undoubtedly the universal fear of a hidden and mysterious danger. Savages and the best trained men of modern civilization have shared the same fear. However, the history of submarines to date has been a record where all the known loss of life has been, not to an enemy, but to those engaged in operating them.

It does not follow from this that the submarine will not yet make a glorious record for itself, but evidently the present type of construction is still far from perfect.

* * *

IN a recent address before the Institution of Naval Architects (England), Rear-Admiral Bacon maintains that in the near future the battleship will no longer be the self-contained unit of today, but will be accompanied by a large armored cruiser and a fleet of torpedo craft. The naval battle will then become an aggregation of duels between two battleships, in which their cruisers and torpedo flotilla will act largely as defenses for the battleships to which they are attached; the smaller craft to keep the opposing torpedo boats at a safe distance, while the battleships hammer each other with heavy guns at what is now long range.

* * *

THAT great explorer, Hudson, when gazing for the first time upon the waters of the vast bay which will forever bear his name, could not possibly have dreamed of what will soon be an accomplished fact. Thirty years ago a survey was made for a railway from the wheat fields of Manitoba to a prospective port on Hudson Bay. The project was one generation in advance of the times, and would have been a failure in those days. What was then a vast wilderness in Manitoba, Saskatchewan, Alberta and British Columbia, is today a great world's factor in the production of wheat. Thousands of miles of recently constructed railroads have developed and are developing these provinces at a rate without parallel in the history of the world.

The chief production of this new agricultural empire is wheat, which finds its largest market in Europe. The distance from the new port on Hudson Bay to Liverpool is considerably shorter than from New York, while the rail haul to port of shipment is also very greatly reduced. Not only will there be created a great freight traffic via this new route, but passengers from Chicago and west will undoubtedly enjoy lower rates than via present Atlantic seaboard ports, while the scenic attractions will draw thousands from the Eastern States.

From the Indian with his paddle and canoe and furs for barter to the modern leviathan with passenger elevators and wireless and thousands of tons of cargo, in a single generation, furnishes one of the most striking contrasts of twentieth century accomplishments.

* * *

THROUGH bills introduced in Congress from time to time, and as a result of attempts on the part of newspaper writers who draw more on their imagination than on facts for their writings, reports are circulated from time to time that the patent system of the United States is not only a source of governmental expense which is not warranted by the results, but that the patents them-

selves which are issued by the government are either a delusion or are used by the owners for purposes of oppression, or to create unjust monopolies, or to hold up the public for exorbitant profits. Of course, a thorough investigation of the real facts and an impartial report of the general effect of the patent system in this country would not be sensational, and hence, from the standpoint of the penny-a-liner, would not make a "good story."

A system of granting patents has been in vogue in Great Britain, Germany, France and other European countries for several centuries; and while the statutes controlling the grant of patents in the United States are based on the British patent law, they contain provisions which have been found to be desirable from the standpoint of the inventor and the public as well.

Within a short time, Great Britain has amended its laws to conform in at least one important respect with the laws of the United States. Prior to 1907, Great Britain would grant a patent to any applicant for almost any invention, provided the papers were in proper form. No attempt was made by the British patent authorities to determine whether the invention had previously been patented in Great Britain or not. The rights of the respective patentees of the same article had to be adjusted in the courts. This has now been changed, and the applicant for a patent in Great Britain will not be granted a patent unless his invention has not been previously patented in that country, in this respect following the laws and practice in the United States.

Up to the present time nearly a million patents have been granted by the United States, and while it is true that many of these patents are for inventions that have never been introduced, and are of such a character as to be uncommercial and should never have been patented, it is undoubtedly a fact that the influence in the development of this country by thousands of these patents has been greater than any other factor.

Whereas, originally patents were granted by a board composed of the President of the United States, the Secretary of State and the Attorney General—and one of the first patents bears the signature of President George Washington—it now requires an organization composed of a Commissioner of Patents, two Assistant Commissioners, several official boards and several hundred examiners, to handle the current business of the United States Patent Office. The expenses of conducting the Patent Office for the year 1909 were not quite two million dollars, but the receipts were eighty-seven thousand dollars in excess of the expenses.

The Patent Office is the only Bureau of the Government that is self-sustaining. During the time that it has been in existence it has turned into the Treasury of the United States, as surplus earnings, nearly seven million dollars.

H. H. WINDSOR.

THE VIOLIN

SYCAMORE that spread a shade,
Where the blackbird, unafraid,
Singing in you, music made;
Pine that murmured of the breeze
Where you leaned to summer seas,
Wood, that once was living tree,
Let the dumb now speak through thee.

Hidden things that know no way
Out into the light of day,
Captives watching for a ray,
Dreamers by some temple gate
Who for moving waters wait,
Wonder-working wood, let me
Touch your strings and set them free.

Bound—you open wide the doors,
Dumb—a voice they find in yours,
Dry—through you the fountain pours,
Inarticulate—they talk,
Paralyzed—they rise and walk.
Wood of magic, haunted tree,
Thus you lay your spells on me.

Till, within a charmed ring
Half-created things shall spring
Into being while you sing,
Crowding in a countless throng,
Crying with a new-found tongue,
Wood of Orpheus, wood of Pan,
Loud you sing the soul of man.

Marna Pease, in the London Spectator.

Canvas Rain Protection for Street Trench

A RECORD IN TELEPHONE CONSTRUCTION

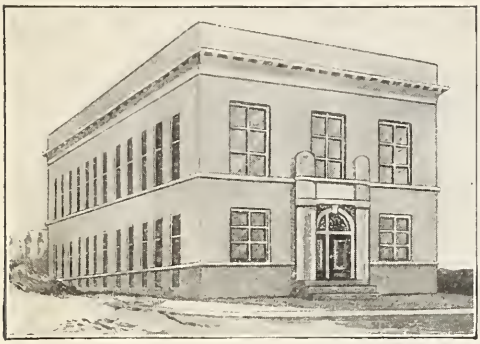
A race to prevent the possible loss of a valuable telephone franchise in Omaha recently resulted in the breaking of all records for telephone construction work. The Omaha company found itself facing the imminent forfeiture of the South Omaha franchise, which, with its big stockyards business, needed the connection. If an exchange were not working within six weeks, the company's rights would be endangered.

No attempt was made to shift or dodge the issue. The company decided that South Omaha should have its exchange—not a temporary makeshift, but a permanent building, with underground cables and full equipment to do business permanently.

In the afternoon of April 11, a court order was issued authorizing construction to be undertaken, and from that moment until the last day of grace, May 23, the struggle was continuous. On the morning of April 12 the lot for the building was surveyed, and contracts were made with the architect and the builder. The architect drew up pencil sketches of the general plan, and these sufficed to start work, details being figured out from day to day as the work progressed. On the morning of April 13 men were excavating the cellar. A few days after it began to rain, and from then on until the end there was hardly one whole pleasant day. The bricklayers were obliged to quit because of the steady rain, but were almost immediately sent back to work again under canvas, scaffoldings being erected to hold awnings. One of the illustrations shows the completed building 35 days after the survey was made. It is a steel frame building with brick walls, 40 by 85 ft.; two stories, with 13-ft. ceilings.

While the building was being erected, work was progressing with the same rush on the trench work. Plans were filed with the city on April 12, 13, and 14, and on April 19, 180,000 duct feet of conduits, in 2, 3, 4, and 6-duct sizes, were ordered from Chicago. Nine days later three carloads were received in South Omaha. The balance came in as needed, and rainstorms were the most serious danger to completion of the task on time. On the second day of the rain the men refused to work in the wet ditch, and, as the excavation was in soft clay, there

was serious danger of the sides caving in. Canvas was immediately telephoned for, and a short time later the ground work presented the tented ap-



Courtesy Telephony

Exchange Built in 35 Days

pearance shown in another of the photographs.

The first connection between telephones was put through on the morning of May 21, forty days after the order was signed authorizing construction. On May 28, eleven days after starting the installation, the complete switching equipment for 1,000 lines was ready for occupation in every respect. No temporary work was done, everything being completed as the work progressed.

"A telephone exchange," says a writer in Telephony, "is usually built after weeks or months of careful planning. The building plans are rough-drawn and worked over by the architects and the engineers. Then they go to the manufacturer of the equipment. Here they are checked and criticised by experts, and finally the permanent plans are drawn. The manufacture of equipment and the construction of the building can then be taken up at the same time, and when the building is ready the manufacturer knows just how his equipment will be housed. Everything is worked out and put on paper, conduit, manholes, cable work, all being mapped out and set down in systematic records. The South Omaha exchange was not built this way, but never did a construction force, working under pressure and in nerve-racking weather, do better work."

ENGLISH START FOR SOUTH POLE—JAPAN ENTERS RACE

The English exploration ship "Terra Nova" with Captain Scott and his polar expedition is now well on its way to the Antarctic. Captain Scott expects to reach the South Pole on Dec. 11, 1911, the day on which the sun reaches its maximum altitude at the far end of the earth. On that day the sun describes a circle at the pole of the same altitude all round, so that, by means of specially constructed theodolites, the location of it can be fixed within one mile.

According to present plans Captain Scott expects to land an exploring party of from 22 to 25 men at McMurdo Sound sometime in the latter part of December, 1910. Then, a little later, a party of six or eight men will be landed at King Edward's Land, and the "Terra Nova" will visit New Zealand and make further exploration. The main expedition will probably start its dash to the pole from McMurdo Sound in October, 1911. Before that time the "Terra Nova" will have returned from New Zealand, and the members of the expedition will be thoroughly hardened for the hardships to be encountered.

A Japanese expedition under Lieut. Shirane has made preparations to compete with the United States and England in the race to reach the South Pole, and is now, unless delayed by change of plans, on its way to the Antarctic. A petition for funds for the expedition was granted by the Imperial Diet in a recent session, and Lieut. Shirane prepared to start from Japan in June.

¶W. W. Brookins, in a Wright machine, broke the world's record for height in an aeroplane, when he reached an altitude of 4,384½ ft. at Indianapolis, Ind., on June 13.

¶An eastern railroad is building a germ-proof dining car, the interior of which will be devoid of carved work, moulding, or any projections.

AERIAL PUSH-BALL IN ARMY TOURNAMENT

A new English game, played on horses by the Royal Horse Guards, was to have been staged as one of the contests in the Royal Naval and Military Tournament, which was postponed by the death of King Edward. The ball, which is filled with gas and looks like a large-sized toy balloon, has to be knocked through such goals as the one shown in the illustration with the aid of wooden rods or wands.

Fighting for a Goal

A TALE OF THE COMET

One of the strangest of all the stories about the recent visit of Halley's comet is told in the Japanese Times. Some ten miles east of Utsunomiya in Japan, there is a village, away from the current of twentieth century civilization. The inhabitants are still leading a primitive life, as may be judged from the fact that the shrine of Jizo in the village is regarded by the people as a protector of all mankind. Such being the case, when the keeper of the shrine told the innocent people that in a short time, there would appear a "broom-star" as the comet is called in Japanese, and that on that day a rain of blood would come down and human beings would be annihilated, they took him at his word. The keeper further said that this calamity could only be avoided by presenting offerings to Jizo. The result was that the shrine was crowded with offerings of great value and the village turned into a Mecca, for the people of the neighbouring villages, hearing of the virtue of Jizo, all came on a pilgrimage. The keeper chuckled to himself, when he glanced over the pile of offerings. The indicated day came, but there was no change on the face of the earth, nor was humanity destroyed. The villagers were wild with anger, and made a raid upon the mischievous shrine-keeper, and subjected him to a severe beating.

OYSTER CATCHES MOUSE

One of the most remarkable mouse captures ever recorded was that of an oyster in the larder of an establishment in Colchester, England. The mouse was searching for food and nibbled at the dainty morsel presented to view in an open oyster shell. The result was disastrous, the oyster closing its shell and catching the mouse as shown in the illustration. Attention was drawn to the capture by the squeaking of the prisoner.

A Live Mouse Trap

A SANDWICH SLOT-MACHINE

A western inventor has devised a slot-machine for the vending of sandwiches. In the center of the machine

A Vehicle of Which Much Was Expected

is a refrigerating device to keep the food in good condition. All the purchaser has to do is drop his coin in the slot and press a lever. The sandwiches not sold are supposed to be taken out every day and fresh ones substituted.

PUSHING A BARREL AROUND THE WORLD

Every month or so someone, from some part of the world, starts out to do a more or less unique walking "stunt," taking a number of years in which to accomplish it. In the accompanying illustration may be seen two Italians who have started out to push a barrel round the world on a wager of $7,500 each. They started from Venice a little more than a year ago, and they do not expect to complete their journey in less than 12 years. Inside the barrel is a sliding carriage which always remains level, and on this are carried provisions, clothing, camp utensils, and tent. A dog, seemingly not as content to walk around the world as its masters, is also seen occupying it.

A FOUR-PASSENGER BICYCLE

This fearful and wonderful contraption was tinkered together by a Los Angeles bicycle man, who used for that purpose two old high-wheelers of approved models in the year 1887. One of them had a little wheel behind, the other had a little wheel in front, so the removal of the small wheels provided a good point of meeting for the two high wheels; for, as the picture shows, the small forks are hitched together in some mysterious way. As weight was no object in the manufacture of this novel vehicle, the frame which connects the two handle bars is built of a couple of 1-in. iron bars, an eighth of an inch thick. This allows ample room for additional passengers and therefore the inventor placed four saddles on his machine, although it seems exceedingly doubtful that it ever carried that many.

A bit of gentle sarcasm directed at the old-fashioned solid tires is the advertisement of somebody's preventive of punctures, attached to the frame.

Curious World-Walking Stunt

¶The City of Mexico is building a city prison which will contain 1,900 separate cells, and will be a model of construction.

MACHINE HANGS WALLPAPER

Wallpaper is trimmed, hung and pasted by a new machine invented by a decorator in St. Joseph, Mo. It consists of a small carrier for the roll of paper, which unwinds and feeds across a paste-container, while at the same time a set of knives trim it accurately. When papering a ceiling, the operator fastens the apparatus to his waist, mounts the scaffold, and walks along it, hanging the paper as he goes. In papering the walls, he may set the machine on the floor near the wall, climb a ladder and pull the paper out of the machine, pressing it against the wall.

A UNIQUE PLACE OF WORSHIP

When a railway car is condemned by the officials of the line as being out of date or beyond repair, it is generally broken up for firewood; but scattered here and there one may observe some strange and novel uses to which enterprising persons have put old railway passenger coaches and freight cars.

The one shown in the photograph is used as a place of worship near a small village about 20 miles outside London. The car which formerly ran many miles on the Great Northern railway, has had its compartment partitions removed and chairs arranged forming a central aisle with an entrance at one end as in a corridor train.

A Sculptured Brick Fireplace

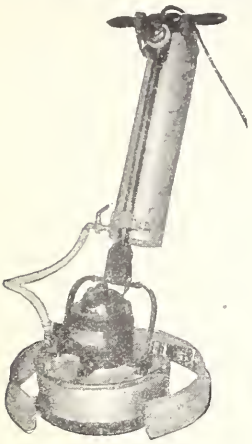
NOVEL BRICK SCULPTURE

Novel and artistic sculpture on the face of a brick fireplace is shown in this illustration. The carving is in flat bas-relief, and drew much attention at the exhibit of the Architectural League in New York.

Old Railway Car Used as Church—Accommodates 60 People

INGENIOUS ELECTRIC FLOOR-SCRUBBER

Electric floor machines for removing old finishes, waxing, polishing, etc., have been on the market for some time, but the machine shown in the accompanying illustration may be used for the added purpose of scrubbing as well. It weighs less than 50 lb. and is simple in construction, all working parts being packed in grease and enclosed within a dust and water-proof case.



When not in active operation the machine rides on casters, but after the motor is started the handle is slightly raised, which action withdraws the casters from the floor, allowing the machine to be propelled over it by the whirling brush. The water is carried in a tank attached to the handle, and is fed through a hose to the brush. Around the brush, with a couple of inches intervening, is a ring which incloses all but the front. The ring keeps the bulk of the water with the machine, instead of allowing it to spread over the floor, and thus eliminates much extra work in mopping up.

When the machine is to be used for floor-polishing and like uses, the tank and brush are removed, and the required attachments substituted.

THE TAILOR OF A BATTLESHIP

Every battleship in the U. S. navy has at least one sailor who is sufficiently proficient in the art of tailoring to be detailed for this work and have $20 a month added to his regular pay. He is also allowed a helper, who is paid $10 a month extra. The duty for which the government pays him this extra compensation is the changing of uniforms to make them fit the owners. He also has many opportunities for making still more money, some of which are the cleaning and pressing of the officer's clothes, repairing uniforms, and making new clothes.

The illustration shows a battleship tailor seated cross-legged behind his hand-operated sewing machine, which rests upon a low bench.

Tailoring Shop of a Battleship

THE HUMAN FACTOR IN PUBLIC UTILITY REGULATION

By J. Q. ROBERTS

IT would seem that one of the last places on earth to look for students of human nature would be the engineering offices of a state railroad commission. The character of such an organization suggests, rather, dull facts and figures, dry statistics and diagrams, musty blueprints and estimates, material things such as iron and stone and cement, stresses and pressures, strength of materials and motive power.

The psychologist, the man who devotes his life to the study of the human mind and its intricacies, makes his observations in the crowded city tenements, in hospitals, in the research laboratories of great universities. His conclusions, largely theories, are set forth in books full of lore, which have an honored place in scientific libraries, but which rarely have any effect on every-day affairs.

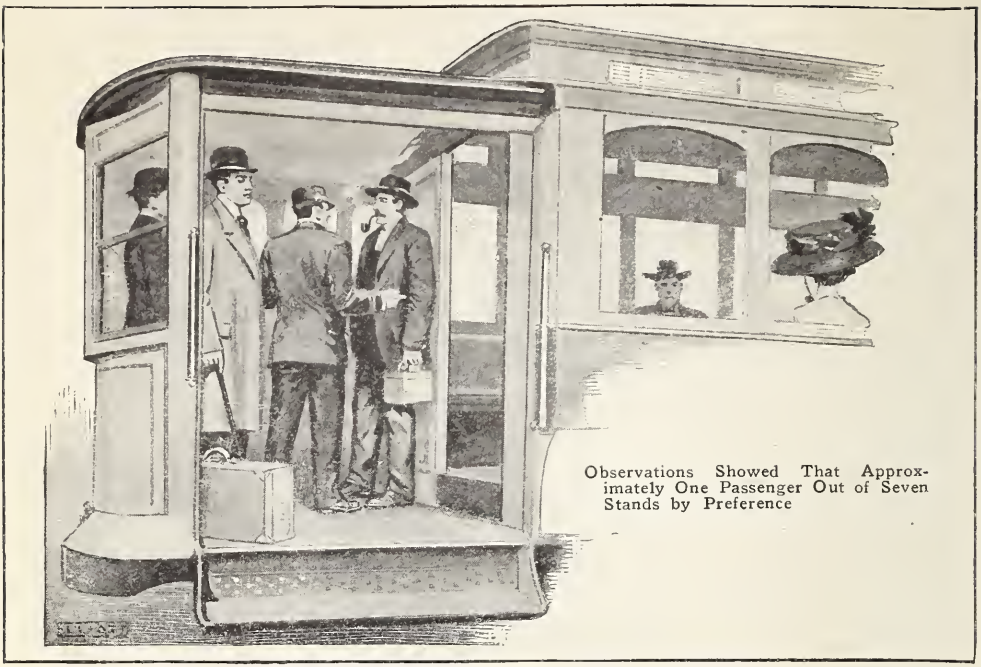
But in the engineering offices of the Railroad Commission of Wisconsin they take the doings of humanity, reduce them to columns of figures, transpose them onto charts, and apply them with unerring accuracy to the work of regulating public utilities. The commission is unique. It accomplishes things. The people of the state have confidence in it. They feel that their interests are in safe hands. And the corporations, realizing the ability and fairness with which it regulates, respect it, and, with few exceptions, have adopted its suggestions without protest.

To the small corporations, the minor public lighting, street railway, and telephone companies, it stands in the position of a watchful big brother. For it must be remembered that all public utility corporations are not giant aggregations of wealth, possessed of means to engage high-priced engineers and lawyers. Throughout every state there are scores of small public utility companies the stockholders of which have never experienced the sensation of receiving a dividend check. Their condition is only too often due to the inexperience or incompetence of managers or employes. In more than one case the inspectors and engineers of the commission have saved such companies from self-destruction by timely advice and co-operation.

Three years of effective work have demonstrated the wisdom of the policy of public utilities regulation adopted by Wisconsin. Although that is a comparatively short time, during those three years the system has worked smoothly and produced order, reasonable charges, and good service, where before there was confusion, discrimination, extortion and profanity-provoking service.

The same technical staff which serves the Railroad Commission also serves the State Tax Commission in the valuation of steam and electric railway properties, and the electric lighting and power plants which are associated with some of the electric railways. The method of determining the valuations has been reduced to an exactness which permits of few disputes between the commission and the companies. Uniform accounting methods have displaced the slipshod individual systems which baffled the most expert state accountants in attempts to learn the financial condition of corporations. A gas company, for instance, cannot claim that its pipe lines are worth $50,000, if the charts of the commission show that the cost of pipe and labor 10 years ago, when the lines were laid, make it evident that the work could have been done for half that amount.

The chief engineer and many of his assistants are members of the faculty of the University of Wisconsin, professors and instructors in the engineering departments. It is the way these



Observations Showed That Approximately One Passenger Out of Seven Stands by Preference

engineers, these men of facts and figures and immutable physical laws, have applied the human factor in this work of regulating public utilities, that makes the Wisconsin commission unique. By thousands of observations, made under normal conditions of service they have discovered, for instance, that telephone service is poorer on a dismal, cloudy day than on a fair day because of the effect which the weather has on the mental condition of the telephone girl; that badly ventilated offices affect telephone service for the same reason; that a certain percentage of persons using street cars are strap-hangers by preference, and that there is a great difference in the quickness with which people of different large cities board cars. An Indianapolis man will board a car in 1.02 seconds, but it takes the average Milwaukee man 1.5 seconds to clamber aboard. Through thousands of observations these results showed that for some inexplicable reason Milwaukee people are slow in boarding cars.

One of the most elaborate single investigations yet undertaken by the commission's engineers was in connection with a street railway fare case and complaint on service coming from the city of Milwaukee. This investigation covered the street railway service then being given by the Milwaukee Electric Railway and Light Company, the service needed by the people and the changes in schedules and routing of cars necessary to give the kind of service needed.

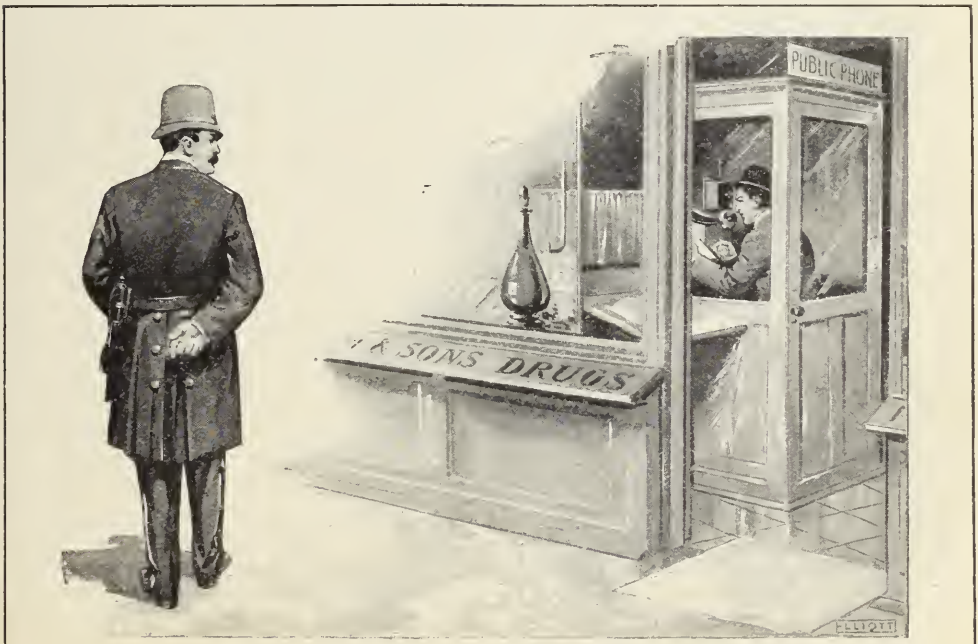
In order that the investigations might disclose the real conditions then existing and the real character of the service being rendered by the street railway company no information whatever was given out concerning the commission's plans and proceedings in these matters. The work was begun in secret and carried on for several weeks without the knowledge of either the company or any of the city authorities.

The first step was the study of the traffic as a whole. It soon became obvious that the heaviest traffic or greatest travel occurred between 6:00 and 9:00 a. m., 11:00 a. m. and 2:00 p. m., 5:00 and 8:00 p. m., and 10:00 to

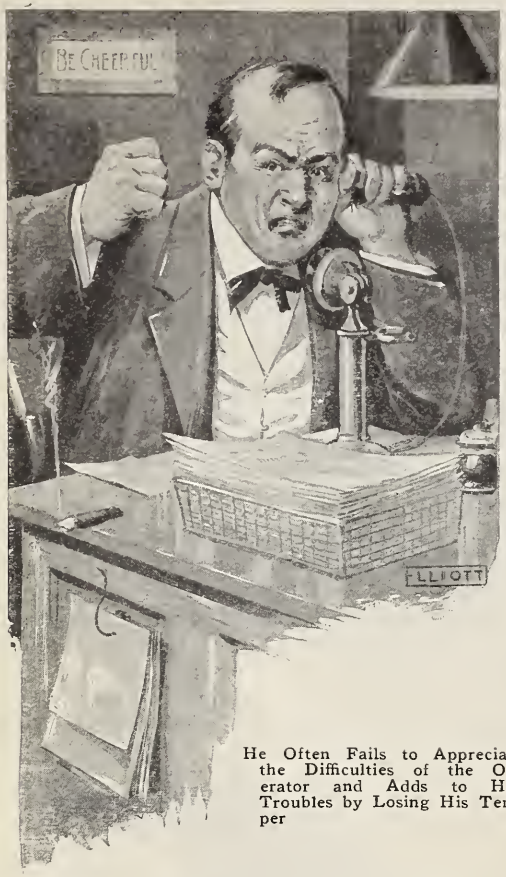
11:00 p. m. The observations were then confined largely to those periods as there appeared to be no reason why any scheme for handling the traffic during those periods would not prove entirely adequate during other parts of the day.

The 14 main lines of the street railway system were then investigated in much detail for each of the different periods of heavy travel. Inspectors collected data as to the number of passengers riding, the number of cars, their times of arrival, and such other facts as would be of value in dealing with the traffic conditions. For a number of days the traffic would be studied closely on one line only, but at several points, in order to determine the average number of passengers riding on that line at those points, the amount of overcrowding if any, the origin and destination of passengers, the number standing by preference (as shown by the existence of vacant seats) and other matters of a similar nature which would thoroughly familiarize the inspectors with the various traffic conditions. Observations on about nine thousand cars showed that quite a number of the people riding really preferred to stand even when seats were available, and this tendency was so pronounced that it seemed to follow a fixed law.

In fact, observations showed that in 1,499 cars an average of two people stood by preference when only 10 to 14 people were on the car. In 1,483 cars observed, three people stood when there were only 15 to 19 passengers. In 1,411 cars observed, four people stood out of 20 to 24 riding. In 392 cases, in which there were from 40 to 42 passengers on the car, eight of these stood by preference. Therefore, for a car having a seating capacity of 42 people (the size of the street car in general use in Milwaukee), a "comfortable load" was taken as 50 passengers, on the assumption that if eight people preferred to stand, even if seats were provided for them, it was therefore unnecessary to provide seats for these eight people. A car which afforded seats for 42 people could then be called



Inspectors Making Secret Telephone Tests Were Regarded as Suspicious Characters



He Often Fails to Appreciate the Difficulties of the Operator and Adds to Her Troubles by Losing His Temper

upon to carry a load of 50 people "comfortably" under these conditions. A number of reasons might be suggested as explaining this preference of a number of passengers to stand rather than to sit down in available seats. The passengers may wish to stand on the rear platform and smoke, they may prefer to stand on the front platform for observation, or they may have been sitting down all day and prefer to stand for that reason, or, having only a short distance to ride, they may not care to go to even the slight trouble of selecting one of a number of available seats. In fact, there is a wide variety of reasons why a number of the passengers should prefer to stand rather than avail themselves of seats, and this tendency, as shown above, seems to obey a general law which is graphically illustrated in the accompanying diagram.

Another point covered in the investigation was the movement of passengers in alighting from and boarding cars. It was noted that passengers in Milwaukee were slow in alighting from and boarding cars as compared with the average passenger in other cities. From observations made in St. Louis, St. Paul, Minneapolis, Duluth and Indianapolis, as well as Milwaukee, it was determined that during the evening peak in the down-town districts of these cities, it required an average of 1½ seconds per passenger in Milwaukee to board a car when 10 passengers were getting on. This is contrasted with 1.37 seconds in Duluth and St. Louis (pay-as-you-enter), 1.25 seconds in Minneapolis, 1.20 seconds in St. Louis and St. Paul, and 1.02 seconds in Indianapolis. When five people boarded a car, the average in Milwaukee was also longer than that of any city.

At Indianapolis five people would board a car in an average of 1.25 seconds per passenger, while at Milwaukee 2.12 seconds were required. And even when 15 passengers were boarding a car, there was considerable difference in the time required by the average passenger between Milwaukee and the other cities investigated. As a matter of fact, the best time made at Milwaukee was approximately 1.20 seconds per passenger, no matter how large the crowd, while the other cities attained an average of approximately 0.8 seconds per passenger when from 15 to 20 people or more boarded the car. In a general way, this same feature was noted in the movement of passengers when leaving cars, in all the cities mentioned.

At the first glance it would appear that this slowness was due entirely to

the passengers themselves, but upon investigation it was ascertained that the company was partly to blame, due to their having no definite established stopping-places for their cars. For instance, a car might stop exactly on the other side of the crossing, while the car following might stop a car-length or so past this point. The people would generally congregate at a certain place, expecting to board the car there and when the car proceeded 30 or 40 ft. past this point, it was necessary for them to walk or run to it. This caused a delay and thus required considerably more time in boarding the cars than would otherwise be the case. There were a few other minor points noted by which the movement of the passengers could be facilitated by action of the company, as well as by more co-operation on the part of the people themselves.

The Efficiency of Operators May Be Reduced by Heat and Humidity

The inspectors, working in secret to note normal conditions, not conditions when the companies were aware that their service was being tested, were on several occasions regarded as suspicious characters and taken in charge by policemen. One telephone inspector, securing data on the time of answering calls, would go into a public telephone booth, call a number at random, and hang up the receiver when the party on the other end answered, with the excuse that he had called the wrong number. He had been doing this in one town for two or three hours when the subscribers began to notify the police that a man had called their houses for the purpose of finding out if the occupants were at home, with the intention of robbing them if they were not. The inspector was rounded up by a policeman, and, his statements not being satisfactory, he was hustled away to headquarters. Here an audience with the chief was soon arranged, and to that official enough of the facts were given to satisfy him, and to obtain his assurance that the information given would go no further.

From six to eight members of the engineering staff have usually been engaged in the making of periodic inspections of gas and electric service in all parts of the state. The inspectors are equipped with calorimeters, pressure-recording gauges, recording voltmeters, etc., for testing the service, and other instruments for testing consumers' meters. These instruments are shipped by express from place to place, packed securely in special trunks or shipping-cases.

Inspections are made without notice to the utility managers, and, in fact, are usually begun without the knowledge of the men in charge of the plants.

The defect in gas service most likely to be noticed first by a consumer is inadequate pressure, and his complaint is usually "poor gas." Many of the first

recording pressure gauge charts obtained by the commission's inspectors showed ample ground for complaint from consumers as to pressure under which gas was supplied at certain times of the day.

By the use of an instrument termed a calorimeter, the inspector determines the heat value of gas. A few years ago nearly all gas sold was used for illumination, being burned in the old open-flame burners now so seldom seen. Today nearly all gas sold is used either in stoves, for heating or cooking, or is burned for illumination in a new type of burner which makes the heating power of the gas of more importance than the lighting power in the old-style open flame. In other words the standard of value of gas has changed from the "candlepower" to the "calorific" standard.

One of the commission's rules states that "a company furnishing gas which, within a one-mile radius from the distribution center, gives a monthly average total heating value of not less than 600 B.t.u. with a minimum which shall never fall below 550 B.t.u., may be considered as giving adequate service as far as the heating value of the gas is concerned."

Before the adoption of the new rules there were some companies supplying gas which had insufficient heating value, and in these cases the increase in such value required by law was one of the improvements brought about in the service.

The entire business of either a gas or electric plant in a small city is very often done by one man alone. Forty-five plants in Wisconsin had but one man each on their pay rolls, upon whom devolved the entire burden of operation, including firing of boilers or the regulation of water-wheels, the running of the machinery, and superintendence, meter reading, collections and bookkeeping—such of that as was done. It has been found that as a general thing very few records have been kept except such as were most essential.

It is natural that inspectors should have found deficiency in technical knowledge on the part of small plant operators. There are those who know nothing about taking care of their equipment, their distribution system, and meters. One operator cut down the speed of his generator and furnished 110-volt service instead of 220 volts, hoping thereby to save his

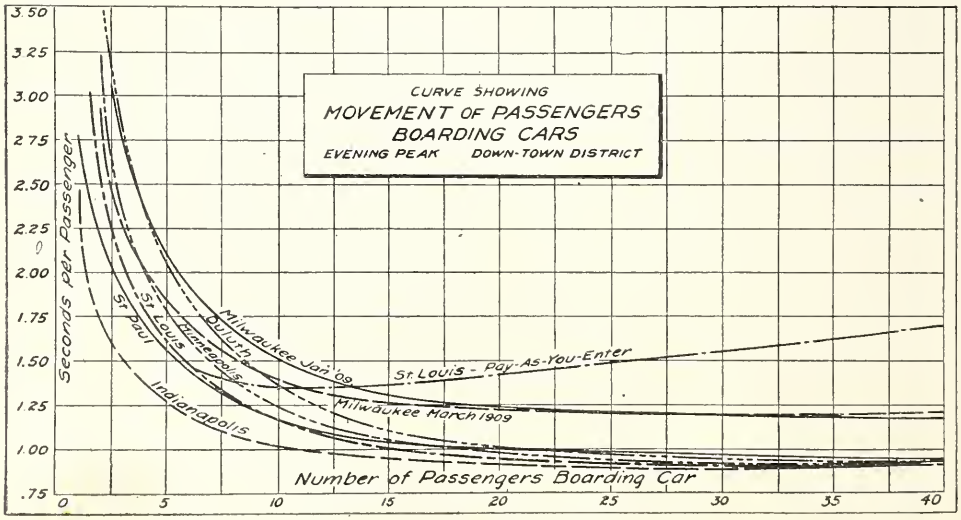
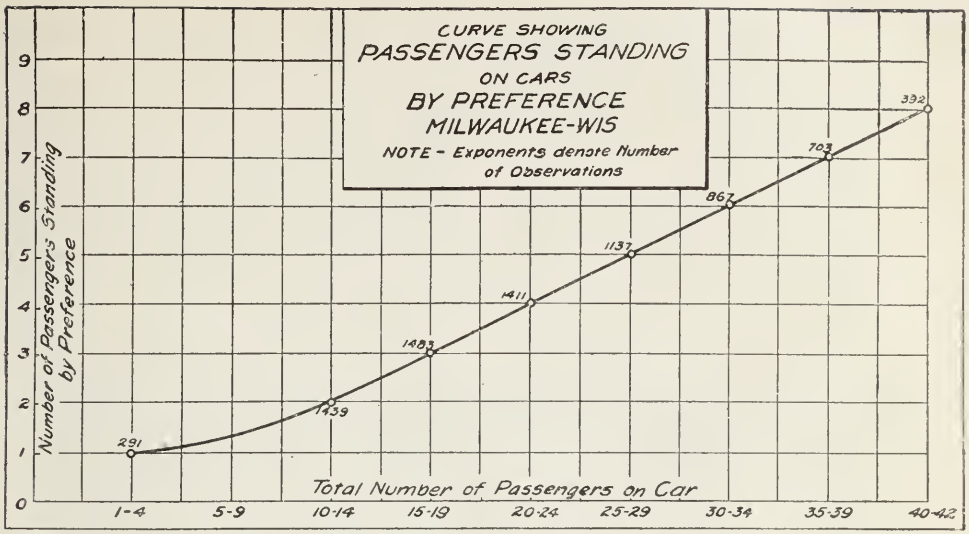


Chart Prepared by Wisconsin Railroad Commission Engineers Showing Relative Speeds of Street Car Users of Different Cities in Boarding—Lower Figures Show Number of Persons Boarding Car at Time of Observations



How the Wisconsin Railroad Commission Established the Fixed Law Which Shows That a Certain Number of Passengers Always Stand by Preference

water supply. One superintendent has been working on the principle that the greater the distance from the station the larger must be the wire, and consequently the wires of largest carrying capacities are employed in outlying extensions. Another operator, on having his attention called to the meter-testing requirements, said he had never been able to find anything about a meter which is adjustable and he could do nothing to a meter found to be fast or slow.

Finding conditions like the above, it is but natural that much of the inspectors' time has been taken up in giving information and instruction to plant operators, and it is believed that as a result of inspection of the smaller plants much has been done toward improvement of conditions.

Lack of profit in operation of small plants, and indeed of some of the larger ones as well, has been found to be due to lack of economies, such as use of feed-water heaters, proper firing of boilers, selection and weighing of coal, covering of steam pipes, repairing of leaks, setting of engine valves, etc. Savings can be effected by installing meters and preventing waste of current by consumers. Small, old-type transformers are responsible for large continuous losses, and it is noteworthy that comparatively little attention has been given to the transformer question. Many plants have a much larger transformer capacity than their generators will carry. Some of the small transformers are badly overloaded, while other large ones carry very little load. This is often due to the fact that no one has followed up these matters, the operator, with his various duties, forgetting that when a large increase or decrease takes place in any part of his system he should change transformers. Many of the systems are equipped with a large number of small transformers of old low-efficiency types, when a few larger transformers would take care of the load much more efficiently and give more uniform voltage.

The telephone exchanges in the 18 largest cities in the state were tested in October and November, 1909. All of these tests were made by the same inspector and therefore errors of "personal equation" were avoided. A double-handed, split-second stop watch was used in making the tests, and the time required to get responses from the exchange operator and from the

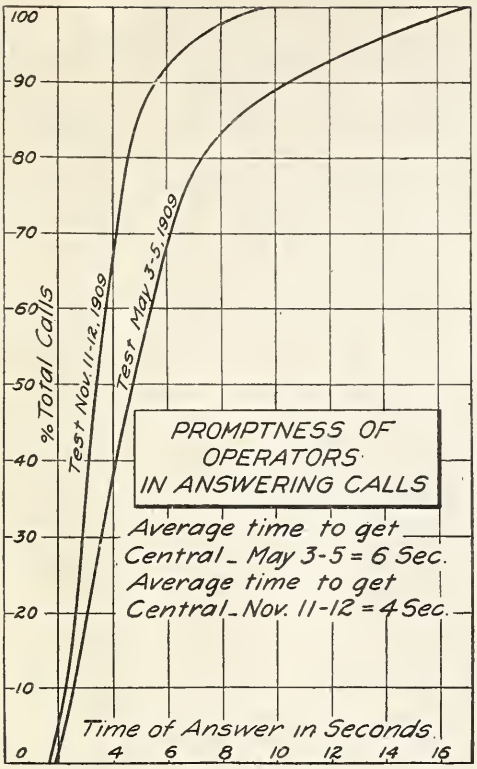


Chart Showing How Telephone Service Was Improved in Six Months—Figures on Left Show Number of Calls Made for Tests.

parties wanted was obtained quite accurately. Other features than promptness of response, especially by the exchange operator, were noted,—such as the percentage of errors in connecting the caller with the party called, the percentage of "busy" and "don't answer" reports and the amount of supervision or attention given to calls by the operator—that is, "central" asks, "Did you get them?" or informs you, "I'll ring again."

The data obtained in all the tests were carefully studied, compiled and compared. Wide differences in the character of service given by the various exchanges were clearly seen. The average time required to get a response from "central" was at least twice as long in some cases as in others.

In the case of one of the exchanges an earlier test had been made about six months before the series above mentioned, and a comparison of the results of the two tests on this exchange showed a very marked improvement in the service given. Subsequent tests on the other plants made by gas and electric service inspectors as a side line of their work have indicated decided improvements in telephone service in many places, and this is clearly the result of the efforts of the commission and the stimulating effect of the knowledge on the part of telephone managers and operators that the service they are giving is being studied by the commission and compared with that given in other cities of the state.

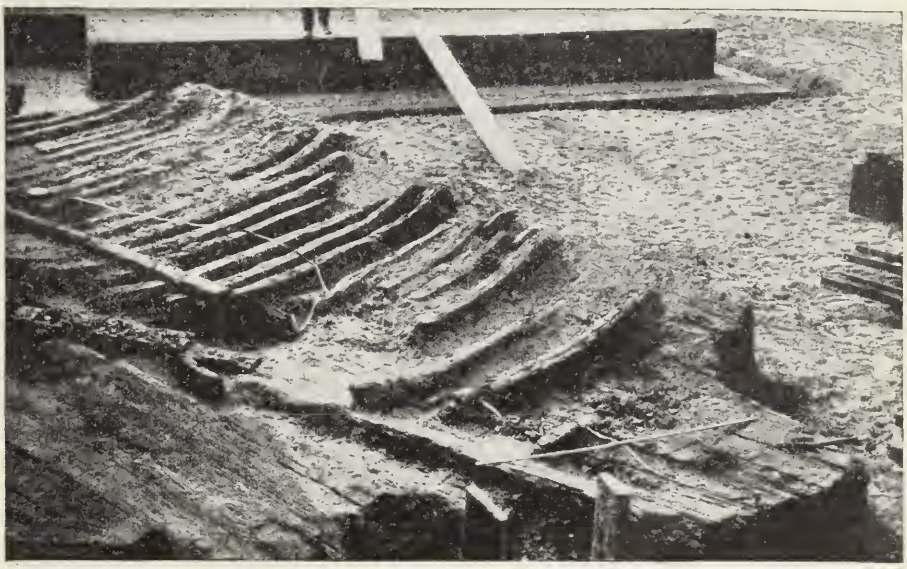
The accompanying diagram is a representation of the results obtained in the two tests, six months apart, on the same exchange. The chart, or diagram, shows that in the May test the length of time required to get an answer from "central" sometimes ran up to 17 seconds, while in November the operator always responded within 10 seconds; 90 per cent of the calls required about 5½ seconds to "get central" in the second test and about 10½ seconds in the first test, and so on.

It was found that the best measure of good service was the quickness of response of operators, although it is easy to gain speed at the expense of accuracy and a large number of wrong connections may be the result.

There are many causes for variations in character of service either between that of different exchanges or between that of the same exchange at different times, many of which are unavoidable, and others may be eliminated. Some which are perhaps not generally appreciated are the extent to which calls may be bunched, or the number of calls going in at the same time, or the amount of the operator's time one caller may take up either necessarily or otherwise, attempts being often made to get a conversation going with "central." The efficiency of operators may be greatly reduced at times by intense heat and humidity, a girl being near the point of collapse under conditions not appreciated by a caller sitting back in an easy chair and in the com-

fortable breeze from an electric fan, and who even under his more pleasant and comfortable conditions loses patience and gives expression through the phone to his annoyance, thus adding to the operator's difficulty in rendering service to him and to others.

A very remarkable fact in connection with the public utility work being carried on in Wisconsin is that the utilities people have in general so heartily responded to suggestions of the commission and its assistants and that the policy of the latter has been to co-operate and assist in the solution of the matters in the hands of the former in the manner that will be for the best interests of all concerned.



Skeleton of Ancient Ship Unearthed in London

REMAINS OF ROMAN CRAFT FOUND IN LONDON

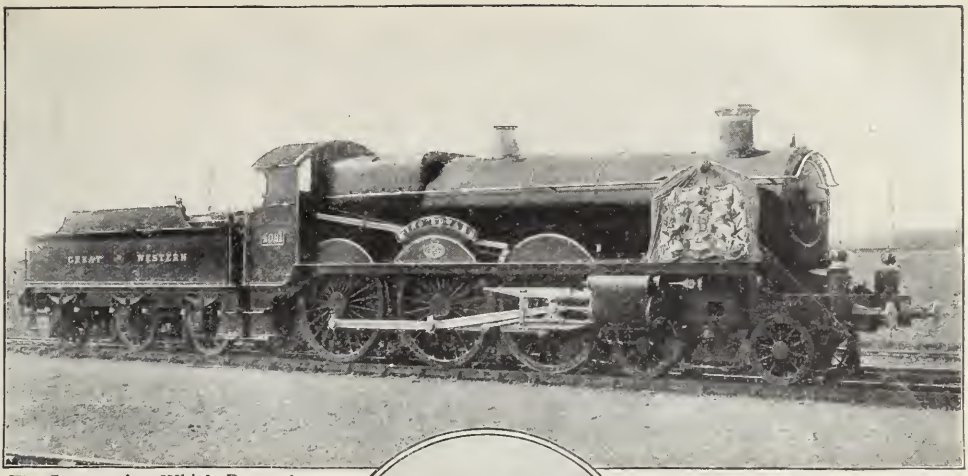
In excavating for the foundations of the new County Hall in London the workmen discovered the remains of a long oak barge, pressed flat by the weight of Thames mud above it. It is believed to have been one of the war barges in which the Romans invaded England. It was cunningly contrived with a stout keel, about 50 ft. long, side ribs set 12 in. apart, and an inside beam measurement of 16 to 18 ft. It was clinker-built, with 2-in. flanking boards. Not one piece of metal went into its making, everything being held together by neatly-rounded dowel-pins. All the material was fine oak.

So rotten were the black timbers found that preservation was decided to be almost out of question. The ribs, again bare to the sky after centuries, were soft to the touch, and probably the only preservation of it will be in the photographs, one of which is shown in the accompanying illustration.

¶Sawdust is being utilized in Germany for the manufacture of cheap blotting paper.

THE FUNERAL OF KING EDWARD

THE ceremonies attending the funeral of the late King Edward marked it as one of the most impressive events of the kind in history. Reigning monarchs of nine countries participated, and almost every section of the earth was represented in the sorrowing throng that followed the body of the king through the streets of London. The above illustration showing the gun carriage bearing the body of the king in the foreground, gives an excellent idea of the manner in which thousands of people crowded into London to view the funeral procession.



The Locomotive Which Drew the Funeral Train to Windsor

And the Gun Carriage on Which the Body was Carried

Mirrors Used by Sightseers Viewing the Funeral Procession of the Late King from Behind the Crowd—Glasses Fixed to a Bamboo Pole and to an Umbrella—Police Strung Barbed Wire on Trees to Prevent Boys from Climbing into Them, but These Wires Were Cut

TAKING MOVING-PICTURES ON HORSEBACK

It is often necessary for the taker of moving-pictures to be himself in motion while he is accomplishing his

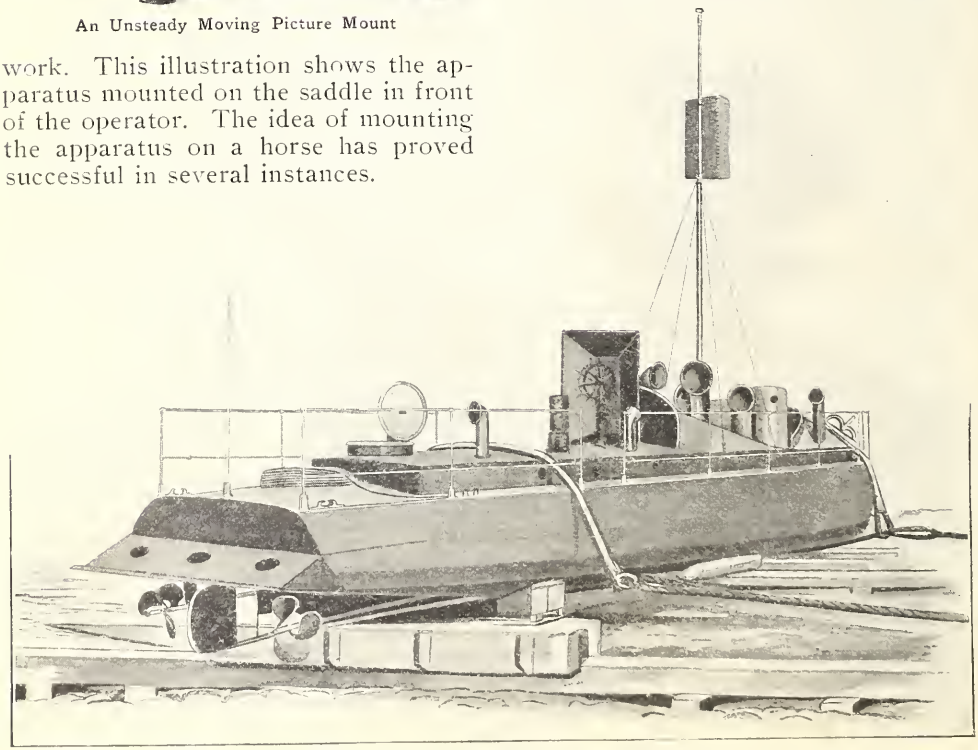
An Unsteady Moving Picture Mount

work. This illustration shows the apparatus mounted on the saddle in front of the operator. The idea of mounting the apparatus on a horse has proved successful in several instances.

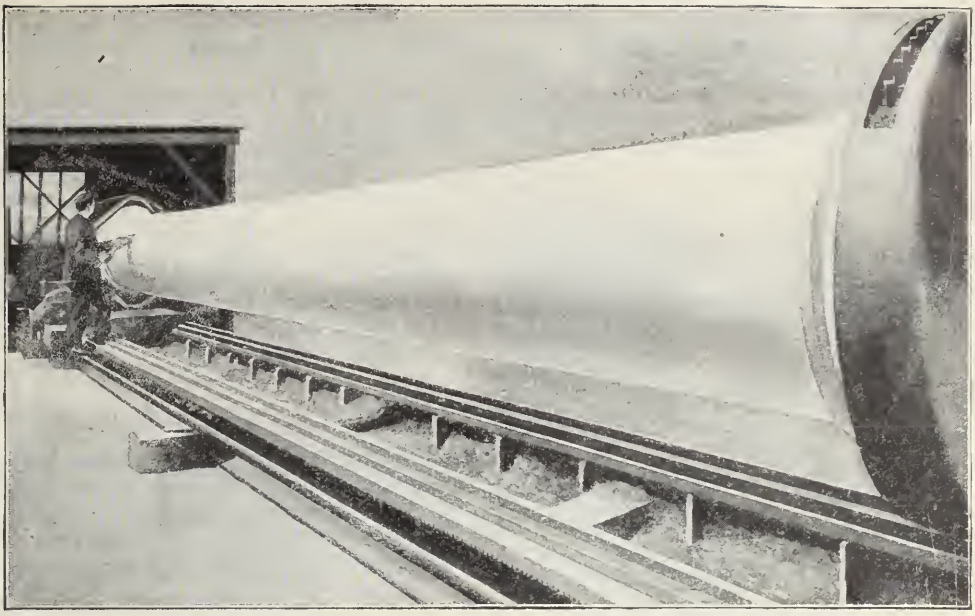
SHALLOW-DRAFT MOTOR GUNBOATS

Motorboats as vehicles of war have been raised to a high efficiency by the Austrian government in the shape shown in this illustration. Four such gunboats are now in operation on the Danube. They are of very shallow draft, and the speed of about 25 miles an hour is made more by sliding over the surface of the water than plowing through it.

The propulsion force is contained in five sets of gasoline engines, driving three propellers. The middle propeller shaft is driven by one set of engines, and each of the wing shafts by two sets. The curious extension stern arrangement by which the burying tendency of the propellers is offset is clearly shown. Were it not for this arrangement the stern would become completely submerged and drag badly with the propellers working at full speed.



Stern View of the Austrian Motor Gunboat



Courtesy Monumental News

At Work on a Huge Marble Column

Other features of exceptional interest are the shield that protects the officer in command from an enemy ahead, and the armored cage or crow's nest on the mast, from which an excellent lookout can be kept over the banks of the river.

The length of the fighting motorboats is 60 ft., with a beam of 9 ft. The hull is of steel, made exceptionally strong forward to withstand the shock of water when running at high speed. The machinery compartments, gasoline tank, gun turret amidships, and conning tower are protected by bullet-proof plating. The hull is divided by transverse bulkheads into five watertight compartments. The gasoline tank is distinct from the hull, so that in the event of its being damaged, the fuel runs overboard and not into the hull.

TURNING HUGE MARBLE MONOLITHS

In carrying out the contract for the exterior marble for the Curtis building in Philadelphia a Vermont marble company had to provide 14 huge marble columns, monoliths, 30 ft. long, 3 ft. 1 in. at the top, 3 ft. 8 in. at the bottom, and weighing about 33 tons each. These marble columns, which are probably the largest ever turned out in America, required a turning lathe of enormous capacity.

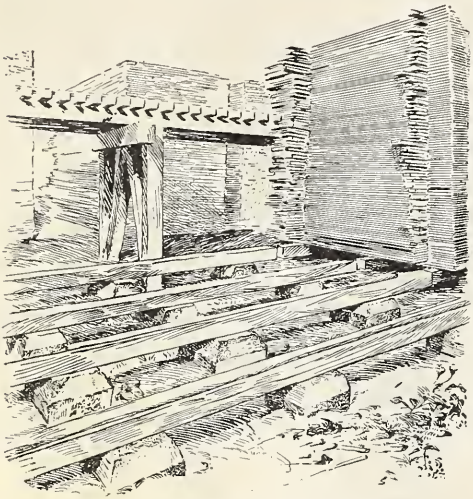
The blocks, as taken from the quarries, weighed from 45 to 50 tons each and were 32 ft. long. An electric crane of 50-ton capacity lifted them from flat-cars and lowered them into the lathe, where they were fastened at each end into square steel frames of the proper size, which passed over the end of the marble and were made secure by set screws.

AUTOS DRIVE TRAINS OUT OF BUSINESS

There is a town in South Africa, according to "African Engineering," where trains have ceased to run, owing to the progress of the automobile. Not only this, but, incisive irony, the station there has been converted into a garage for the housing of the victorious machines. The ticket office, waiting rooms, and other offices are now used as workshops and storerooms.

LUMBER PILES ON CONCRETE FOUNDATIONS

A lumber concern in Cadillac, Michigan, uses concrete foundations for its



Concrete Foundation for Lumber Piles

lumber piles and finds them very stable and economical. The foundations are made of 4 parts bank gravel and 1 part cement, and are 16 by 16 in. at the bottom, tapering to 12 by 12 in. at the top.

WEATHER BALLOON KILLS COW

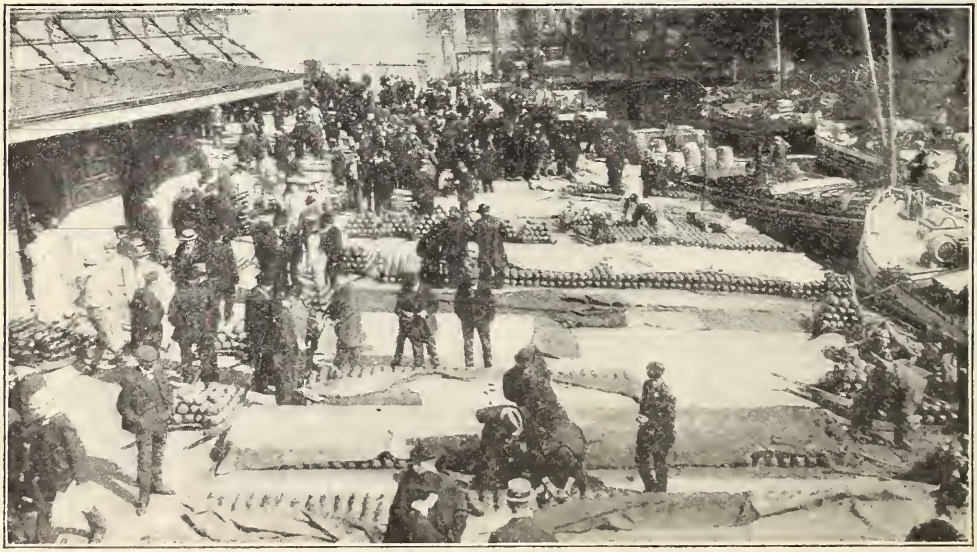
One of the small balloons recently sent up from the Blue Hills observatory for such scientific purposes as recording temperatures, etc., at high altitudes, reached ground again near Amherst, Mass., and forthwith caused the death of a cow. When found, the balloon had been partly swallowed by the cow, which had choked to death in her efforts to get it down.

A CHEESE FAIR IN HOLLAND

Once each year a great cheese fair is held at Alkmayer, Holland, and the stretch of quay along one side of the main canal takes on a most curious appearance. The long rows and pyramids of Edam cheese, as far as appearance goes, might be taken for a huge supply of cannon balls.

The Dutch cheese fair is a very important exhibition in Holland, as agents attend it from all parts of the world to make purchases for a year's supply.

Edam cheese is probably the greatest dairy product of the Dutch country and finds its way everywhere.



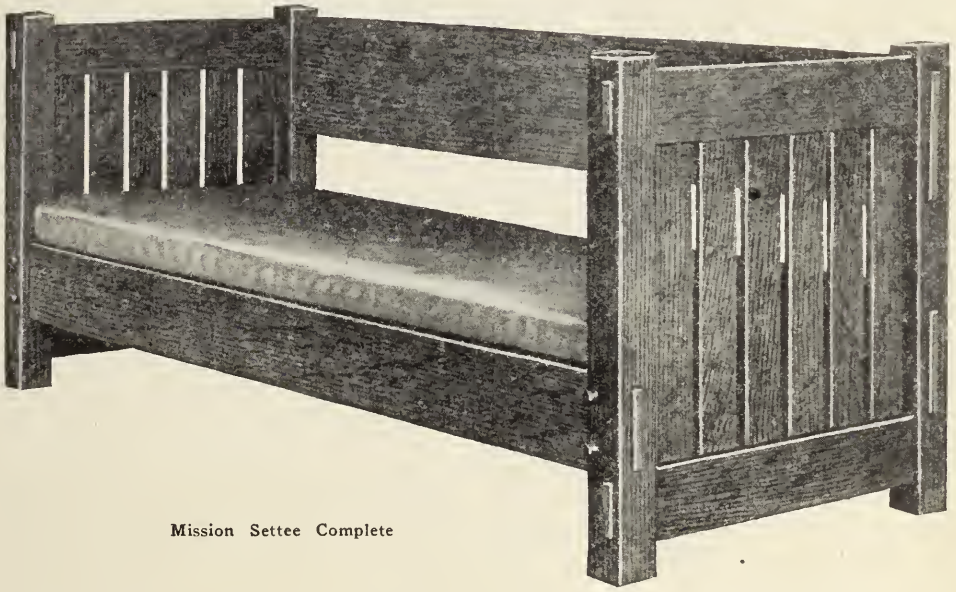
Edam Cheese—Not Cannon Balls

HOW TO MAKE A MISSION SETTEE

The mission settee shown in the accompanying picture should be made of quarter-sawed white oak. The material needed will be as follows:

4 posts, 3¼ by 3¼ by 36½ in., S-4-S.
4 end rails, 1½ by 5 by 32 in., S-4-S.
12 end slats, ⅝ by 3½ by 24 in., S-4-S.
1 front rail, 1½ by 7 by 87 in., S-4-S.
1 lower back rail, 1½ by 9 by 87 in., S-4-S.
1 upper back rail, 1½ by 12 by 87 in., S-4-S.
2 cleats for seat frame, 1½ by 2 by 82 in., S-4-S.
2 cleats for seat frame, 1½ by 2 by 32 in., S-4-S.

On account of the unusual width of the pieces that go into the makeup of this settee, it will be necessary to have the wood thoroughly seasoned before putting them together, otherwise shrinkage will cause them to crack open.



Mission Settee Complete

Begin work by making the ends of the settee first. Cut the posts to length, chamfering both top and bottoms somewhat so that they shall not splinter or cause injury to the hands. Next lay out and cut the mortises as shown on the drawing. With the posts finished, lay out the end rails, cutting the tenons and the mortises into which the ends of the slats are to be fitted.

It should be noted that the drawing calls for the "setting in" of the whole of the ends of the slats, there being no shoulders. This is much easier and gives just as satisfactory a result, provided the sides of the mortises are carefully cut.

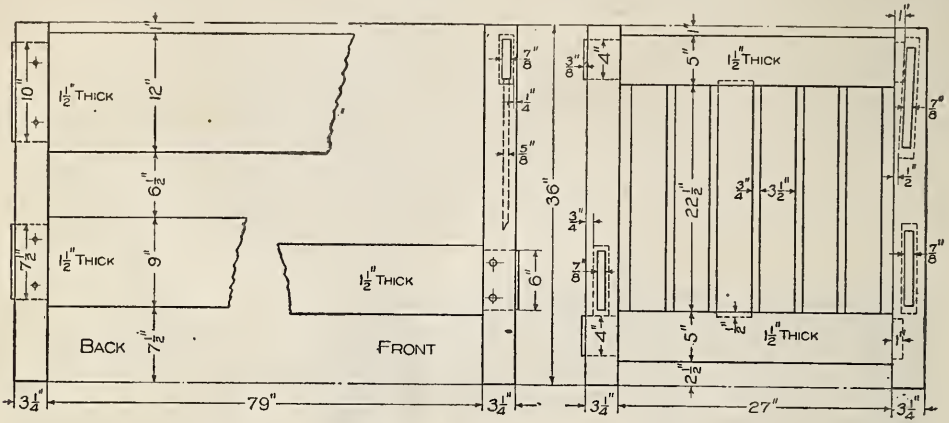
Thoroughly scrape and sandpaper all these parts and then put the ends together. In addition to the glue it will be well to through pin each of the tenons and mortises. These pins may be put in flush and permanent on the ends of the settee. On the side rails, however, the pins are to be allowed to project so that they can be removed, and no glue is used in the joint.

While the glue of the ends is hardening, prepare the rails of front and back. Scrape and sandpaper these and when the clamps can be removed from the ends put the whole frame together. The ends of all projecting tenons are chamfered.

The illustration shows a loose leather cushion. There is quite a variety of materials out of which such a cushion can be made. The best, of course, is leather. In the highest class of fur-

niture where loose cushions are used, the seat base is formed by solidly mortising a frame together on which is woven a heavy cane seating. This in turn is fastened to the inside of the piece of furniture, and the cushions when placed upon it make a very comfortable seat. The stock bill for this settee calls for such a frame. Wood slats may be substituted if desired.

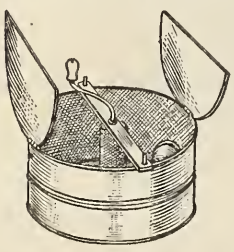
This piece of furniture will look well if finished in weathered oak. See that all glue is removed from the surface, and that the wood is clean and smooth, and apply a coat of weathered oak oil stain. Sandpaper this lightly with No. 00 paper when the stain has thoroughly dried, and put on a coat of lackluster or an equivalent.



Details of Settee Construction

NOVEL POTATO PEELER

A unique potato peeling and washing machine is shown in the accompanying sketch. The lid is shut down when the machine is in operation so that the water will not splash out. The revolving bottom is provided with projections on the outside edge, which turn the potatoes over so as to give every part of the surface equal treatment. Sharp cutting edges around the sides pare the potatoes as they are pushed around by the revolving bottom. In operation the machine is filled with water so that when the potatoes come out they are perfectly clean.



"RESINITE" TO REPLACE CELLULOID AND IVORY

Various art industries in Germany have found a number of uses for a newly invented substance called "resinite." It is produced in a variety of modifications by the union of formaldehyde and carbonic acid in connection with certain metallic salts. The name it bears, states Thomas H. Norton, U. S. consul at Chemnitz, was given it because of its resemblance in an important form to ordinary resin. This special variety is used chiefly with porous materials, such as wood, paper, and pasteboard, and renders them hard and impermeable. Ordinary pine wood, when thoroughly impregnated, becomes so hard that it rapidly dulls a planer.

In another form, resinite can be poured as a liquid into molds. After hardening, it is transparent, with a ruby tint, infusible, and unaffected by ordinary chemical reagents. It is well adapted for making ornaments such as hatpin heads, imitation jewelry, and for most purposes where enamel or enamel

varnish is employed. For doorplates, street numbers, and signs, it is said to be an excellent material, being entirely unaffected by atmospheric action.

Resinite in its third modification is liquid, but upon the addition of a mineral acid it solidifies in a few minutes to an elastic substance which can be easily cut, turned, and polished. In this form it can replace horn, celluloid, vegetable ivory, and similar substances used for buttons, knife handles and mosaic designs.

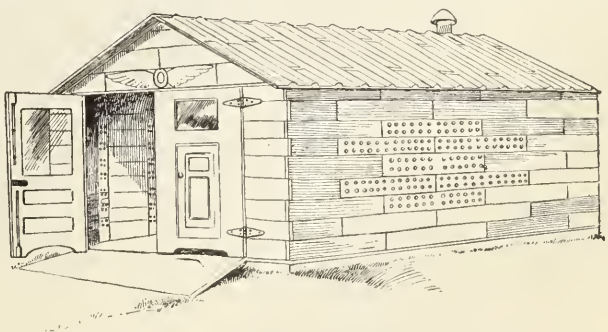
FIRE CAUSED BY FIRE EXTINGUISHER

One of the most extraordinary causes of fire ever recorded has to do with the destruction of the warehouse of a match company in St. Louis, in which a sprinkler tank, provided as a means to extinguish fires, was the means by which the blaze was started.

The tank supports collapsed, and the falling tank ignited the matches, with a resultant loss of $80,000. The supporting structure of the tank, according to the fire reports, had been allowed to rust until the diameter of the steel at places was only $\frac{3}{32}$ instead of $\frac{5}{16}$-in.

PORTABLE CONCRETE GARAGE

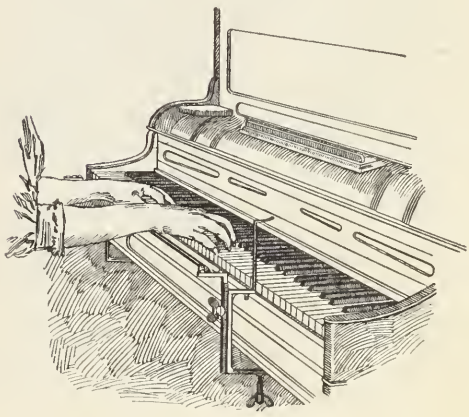
The portable concrete garage is the latest solution of the problem of housing automobiles where the owner wishes to take care of his own machine, and does not care to erect a permanent garage of his own. The walls of this garage are reinforced concrete slabs made in sizes of 5 ft. by 1 ft., and 2½ ft. by 1 ft., both sizes being 1½ in. thick. The frames are of steel, and the concrete slabs are bolted to the framework with screws, the only tool required in the erection being a monkey-wrench. The sides of the garage are made rainproof by use of tongue and groove joints on the concrete slabs, which fit close together so that no mortar is required. The roof is made of copper carried on steel T-bars, and the doors are either wood or metal. A peculiar feature of these garages is that the walls are without windows, light entering through three-inch circular lenses.



Monkey Wrench Only Tool Used in Construction

WRIST-GUARD FOR PIANO PRACTICE

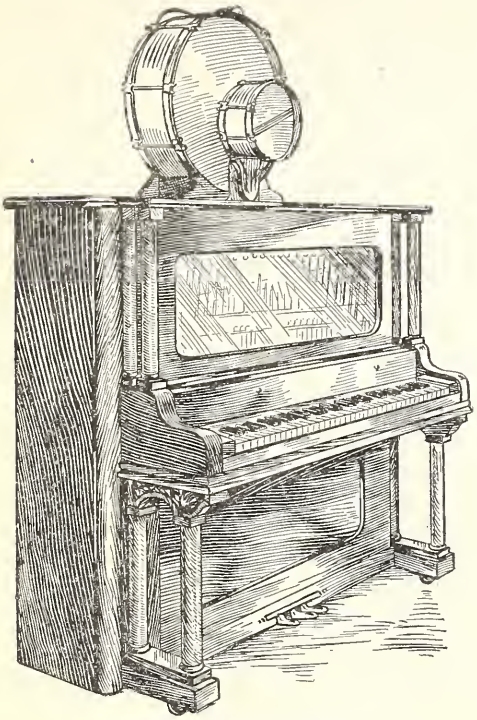
The device attached to the keyboard of this piano is designed to teach the young pianist the proper position of the hands in playing. If the wrists are allowed to fall they touch the wire stretched on a line with the keyboard, which gives way automatically. If the wrists do not touch the wire the pianist is assured that the hands are in the proper position.



Teaches Proper Position of the Hands

AN AUTOMATIC ORCHESTRA

The moving picture theater with its peculiar requirements has inspired the



Orchestra In One Piece

designing of an instrument which is a combination of a piano, a metalophone, a bass drum and a snare drum. It is constructed on very much the same principles as the ordinary automatic player. The proper pedals are automatically operated for soft and loud effects, and the drums can be regulated to any degree of softness, or can be detached for certain pieces.

FLOOD DAMAGES IN MISSOURI

A little over a year ago the state bureau of labor of Missouri began to compile statistics showing the financial loss in that state from floods. To secure reliable results blanks were sent to conservative men in the various counties of the state where floods occurred during July, 1909. The results of this special investigation in the 43 counties above the Missouri river and the 10 counties bordering on the south side of the river are startling. In that month more than 1,485,290 acres of land were overflowed, while the crops destroyed were worth $18,896,340.

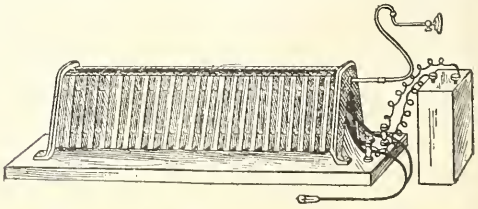
The loss in the Missouri river bottom for the year 1909 was not as heavy as in 1908, because many farmers were able to thresh and haul their wheat from the lowlands before the floods occurred, while the 1908 overflow occurred just before the wheat harvest.

Should three heavy overflows occur every 10 years, and this is said to be a conservative estimate of the number of such floods, the loss in 37 years, which is an average lifetime, would be more than $100,000,000. The idea in gathering the above figures was to show the advisability of spending money to construct new channels and build levees.

BATTERY TAKES ELECTRICITY DIRECT FROM HEAT

Some time ago this magazine described an apparatus by which an American had successfully generated sufficient electric current direct from the rays of the sun to operate his small workshop. The curious heat battery here illustrated works on the same principle, except that the heat is obtained from a gas flame instead of the sun.

This battery has 50 "thermo couples," consisting of alternate bars of copper



This Battery Makes Electricity by Being Heated

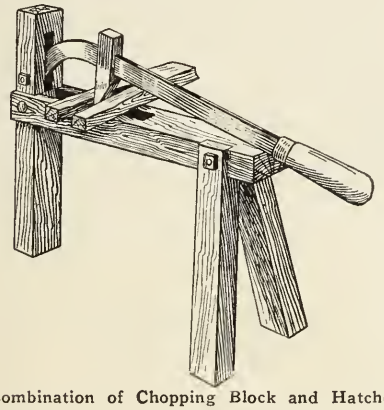
and bismuth-antimony alloy. Upon each junction is a tiny gas jet, the supply of gas being obtained from an ordinary gas fixture. As soon as the metal-

lic junctions heat up, which takes only a few seconds, a current is generated at about 4 volts pressure, and the output is from two to four amperes. This is only sufficient to allow the charging of one 2-volt cell at a time, but demonstrates what may be possible in the future with a larger heat battery for the charging of cells for automobile lighting and ignition.

The production of electricity direct from heat in sufficient quantities to be commercially practical has been a dream of scientists for many years. The principle of the thermo-pile battery is that, if the junction of two pieces of dissimilar metal be heated, a very feeble current is produced, but by multiplying the number of these junctions, a current of appreciable strength can be obtained.

A NOVEL WOOD CHOPPER

A contrivance which will be welcomed by many small boys who dislike to chop wood, has been brought out by an English firm. This combination of hatchet and chopping block is mounted on a strong wooden bench. A long iron arm, on which is affixed a sharp pointed steel blade, works as a lever. The steel blade is 1 in. in width, and splits rather than chops the wood. The

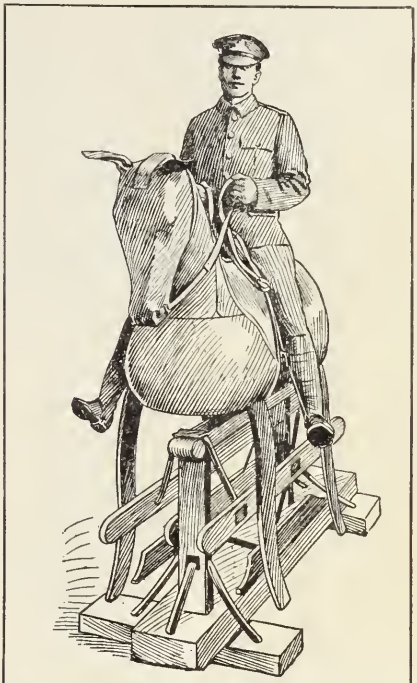


Combination of Chopping Block and Hatchet

leverage obtained enables the chisel head to drive quickly through the toughest wood. The machine, too, obviates the danger of chopping the fingers instead of the wood.

MECHANICAL STEED FOR TRAINING CAVALRYMEN

The rocking-horse brigade has become a reality in the English army, for



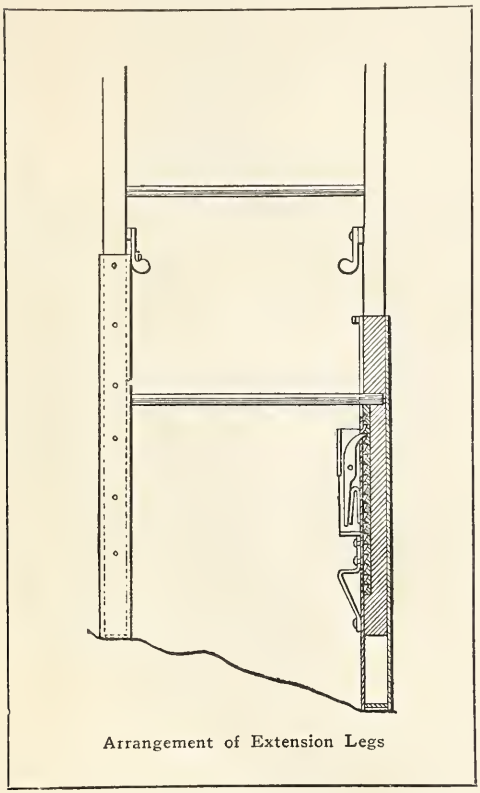
English Cavalryman Astride "Back Ache"

the embryo cavalryman may now take his first lessons in riding on a docile, mechanical steed. The rocking-horse is said to provide most of the sensations experienced when riding a flesh and blood horse. At any rate the novice in the art of managing a horse gets all the advantages that are necessary to his preliminary training and none of the dangers. The horse's head is hinged and is said to be so cunningly fitted with springs that its rider soon learns how to feel its mouth. Furthermore, it is guaranteed to stand still while being harnessed. The horse is called "Back Ache."

¶Preparations are being made by the Insular Government to install a complete wireless service throughout the Philippine islands.

FIRE LADDER WITH EXTENSION LEGS

The necessity of often having to raise a fire ladder upon uneven or sloping ground has resulted in the invention shown in this illustration. The base of the ladder has extension legs, which may be lowered or raised to conform with the ground conditions. The extensions are really sleeves sliding over the legs proper. When one of the sleeves is to be extended, the operator places a foot on the bracket the sleeve is provided with, and depresses it until the sleeve base touches the supporting surface. On the inside of the leg proper is a ratchet rack, provided with 16 teeth. As the sleeve is pushed downward a pawl slips over these teeth, any one of which it will solidly engage with when the base of the sleeve meets a supporting surface.



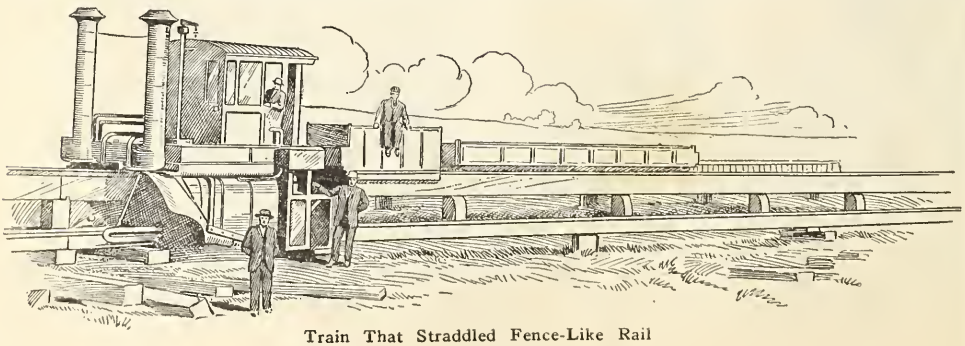
Arrangement of Extension Legs

TONS OF DYNAMITE EXPLODE AND SHAKE TOWN

Three lighters in the Harbor of Kobe, Japan, loaded with dynamite, were sunk by the explosion of one of them, and scarcely a house in Kobe escaped some damage. One of the lighters, carrying 130 tons of the explosive, caught fire, and the resultant explosion and upheaval caused the other two lighters to sink without exploding their loads. The fire burned a sufficient time to allow nearby steamers to reach a safe distance before the explosion occurred.

OLD-TIME MONORAIL STRADDLED BY TRAIN

The recent success with the English and German gyroscopic monorail systems has drawn attention to a curious railroad operated for the transportation of passengers and freight between Stratford and Gilmour, Pa., about 1878. It was a sort of monorail road, but the train was kept on the rail by straddling



Train That Straddled Fence-Like Rail

it as a boy straddles a fence. On each side of this single rail, and lower down, was a guide rail, which served to keep the train balanced, while the fence-like rail supported its weight.

This extraordinary road did a profitable business until the boiler of the engine blew up, killing six people. After the accident the road was abandoned.

TELEPHONE SET USED IN U. S. NAVY

The necessity of a telephone set that will admit of issuing orders to gun crews while the guns are in action has resulted in the compact mechanism here illustrated. The two chief requirements were the deadening of outside sound so that the orders could be clearly heard, and the perfect freedom of the hands, both of which this set meets.

It consists of a combination of steel bands, provided with suitable adjusting facilities, on which two receivers and a transmitter are mounted. Two receivers are used so that all outside noise will be cut off from both ears. They are suspended by a ball and socket arrangement which allows them to fit tightly against the head. The outside noise is deadened by felt. The transmitter is so arranged that it can be adjusted to come directly in front of the mouth.

SEAT-SIGNAL SYSTEM FOR THEATERS

This system makes it possible for the ticket-seller of a theater to know just which seats are in use and which vacant. Each seat is represented by a tiny electric light on a plan of the theater under the glass top of the selling counter. The lamp representing each seat burns as long as the seat is vacant, and an electrical contact on the

Unoccupied Seats Designated by Electric Lamps

seat extinguishes the lamp when it is occupied.

According to the inventor, the ticket seller may display an "all seats occupied" sign when every lamp is dark, and may sell additional admission tickets whenever any lamp is again glowing, indicating that patrons have left their seats.

WELDLESS CHAIN FROM CRUCIFORM BARS

The means by which weldless chains are made by a British concern is clearly explained by this illustration, which shows the transition of a cruciform steel bar into links. The length of each chain is in proportion to the width of the cruciform bar. When longer chains are needed than it is possible to make

The Stages of a Weldless Chain

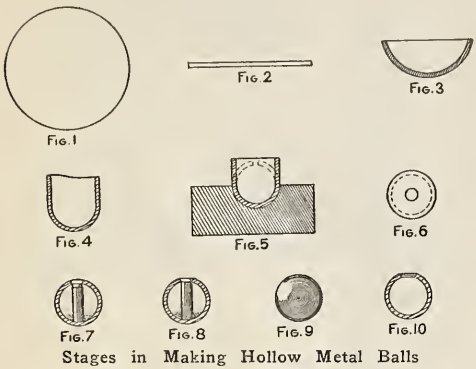
from one bar, a connecting link, made of the finest quality of welding steel, is used.

The weldless chains are said to be very light in proportion to their strength.

¶Canada produced 3,111,249 lb. of arsenic during the past year.

METHOD OF MAKING HOLLOW METAL BALLS

The accompanying sketches show the different stages in a new method of making hollow metal balls which was



Stages in Making Hollow Metal Balls

patented recently. A disk made from sheet metal of the desired thickness is first punched out so that it has the appearance shown in Fig. 1 and edgewise like that in Fig. 2. The first forming operation in a press is that illustrated in Fig. 3, while a second operation causes it to have the appearance indicated in Fig. 4. After it has been trimmed to dimensions it has the shape shown in Fig. 5. The next step is to form a sphere of it under the press and to ream out the hole to size. When done it looks like Fig. 6. In Fig. 7 is shown a sectional view of the ball after a metal plug has been forced into the hole to reinforce it. This serves to stiffen the ball. The joint is now filled with galvanizing, tinning or brazing material and the whole placed in a furnace and heated so that the mass will cover the surface and penetrate the joint completely. In Fig. 8 the ball is shown ready for melting the galvanizing material and in Fig. 9 a completed ball is illustrated. Figure 10 gives a detail of special construction. The balls thus made, the inventor claims, may be used as ornaments, anti-friction balls, casters, valve balls, etc.

¶The manufacture of paper from beet pulp is to be undertaken in Colorado.

THE "BARGEES" OF THE FRENCH RIVERS

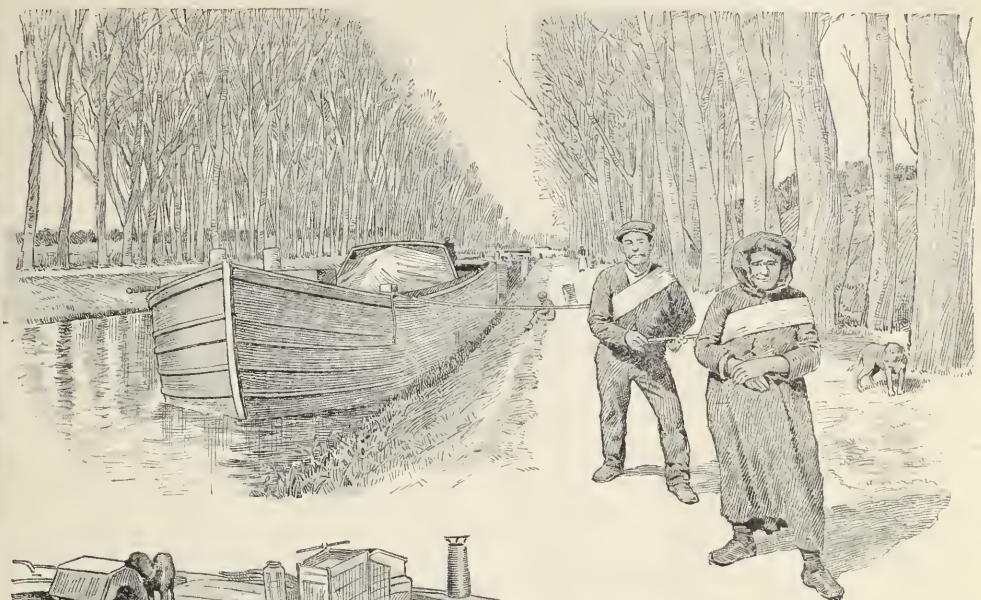
The life on the innumerable barges that traverse the rivers and canals of France, carrying cargoes of any kind of material imperishable within a month, is interesting and fascinating. Each barge represents a private residence, inhabited by the owner or navigator, his wife, one or more children, and often a dog and a cat.

"The bargee folk live according to nature and inclination—that is, they avoid fixed rules," says World's Work, London. "There is a glorious uncertainty as to every detail of their existence. It is impossible for them to tell beforehand what rivers and canals they may have to traverse. For a barge does not confine its journeys to a single line or route, but from month to month is sent down from Paris over a widely varying area and veritable network of 'liquid roads.' "

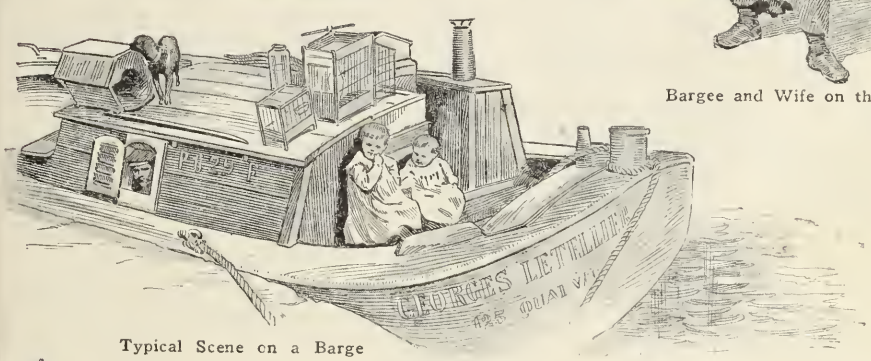
The speed of the passage depends on whether the barges are towed by tugs, drawn by horses, or by the bargees themselves, which often occurs on short narrow canals, as one of the illustrations shows. Barge traffic is the cheapest form of water transportation, although slow, and many million tons of cargo are carried by them annually. On the larger waterways as many as 10 or 15 barges, sometimes more, are slowly towed along by puffy little tugs.

In summer the occupants of the barges bathe in the rivers constantly, for the bargees can swim like water rats. At ordinary times it is customary to wash when it is considered desirable, at any hour, and usually on the main deck.

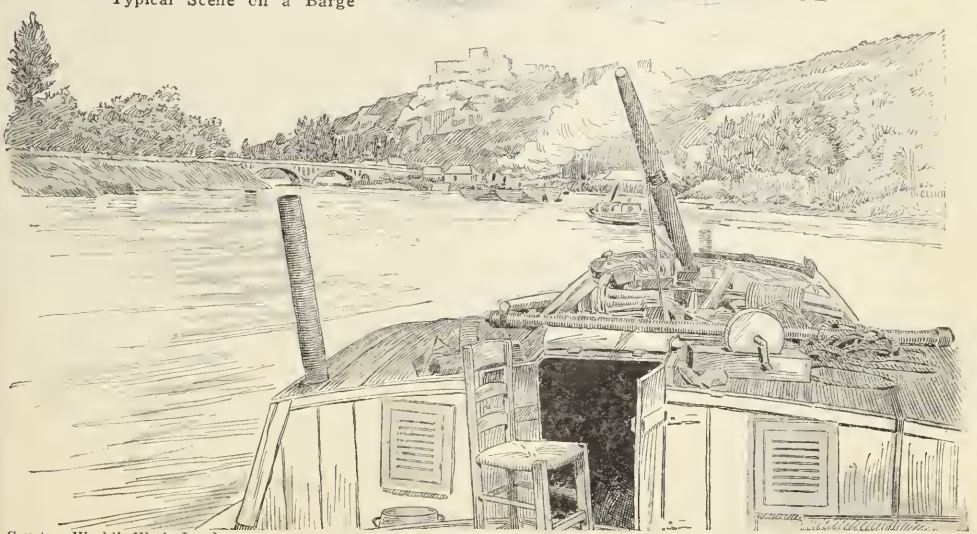
These water gipsies refuse to be bound by unprofitable and unnecessary fetters. They daily feel the delight of unknown coming things. In matters matrimonial French bargees differ greatly from their general countrymen, repudiating the bargain and barter system of choosing a wife. If a young man falls in love, he proposes to the girl without interference from parents, and



Bargee and Wife on the Tow-Path



Typical Scene on a Barge



Courtesy World's Work, London

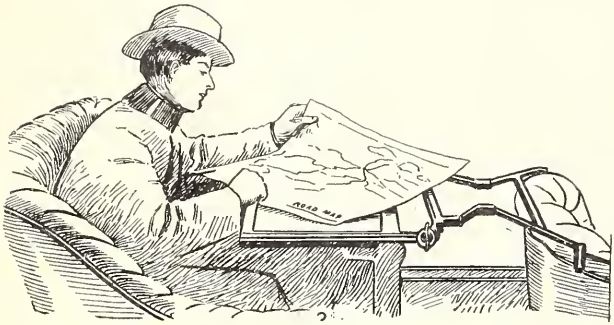
String of Barges Towed by a Tug

he proposes quickly. He must know his mind and know it at once, for after meeting the girl in some quay or port, the barges may move and they may never see each other again for years. The bargees rarely intermarry with land-folk, but sometimes with bargees of other countries.

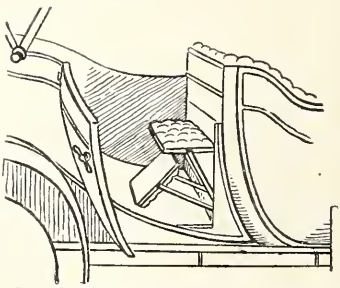
When barges pass each other, there follows a lively exchange of salutations, and friends and relatives who have not encountered each other for months, sometimes years, shout eager greetings and scramble across for short visits. Family affection is said to be always strong.

NEW AUTOMOBILE ACCESSORIES

Five accessories of interest to the automobilist are shown in these illustrations. They include a combined foot-rest and spare seat, a spare seat that folds into the floor, a writing case with electric light arrangement, a special tool cabinet, and a dust shield that can be used as a table.



Dust Shield Converted into Table

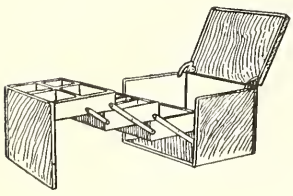


Combined Spare Seat and Foot-Rest

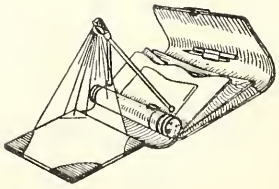
Some sort of a foot-rest is considered a necessary convenience for occupants of the rear seats of a car. To meet this, an English concern has devised a piece of furniture which can be used either as a brace for the feet or as a spare seat. The foot-rest is converted into a seat by turning its face over and attaching it to slides in the back of the forward seat. The other spare seat shown in the illustrations is devised to fold into a recess in the floor when not in use.

The dust shield is very convenient, when converted into a table, as a surface on which to examine road maps and guides. The arrangement of the extending joints is very clearly seen. Used as a shield, it protects the occupants of the rear seat from wind and dust.

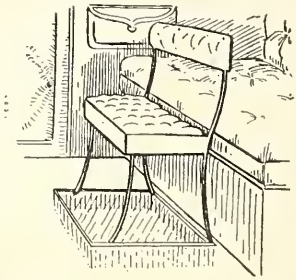
One of the most ingenious accessories recently placed on the market is the writing-case provided with a battery and adjustable electric lamp. The bat-



Special Tool Cabinet



Electric Lighted Writing Case



Spare Seat That Folds into Floor

tery is of the same type as the circular flash-lamp. It is claimed to give eight hours' light, and can be used for reading as well as writing. Its arrangement in connection with the writing-case is clearly illustrated.

The other accessory shown is a tool cabinet provided with three sets of trays, connected in such manner that they may be drawn out to form tiers like those of steps. The side of the cabinet, which draws out with the top tray, forms a support.

SEWAGE-DISINFECTING BLEACHING POWDER

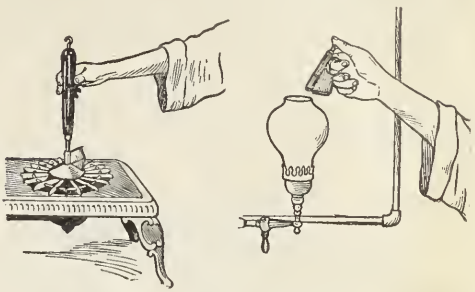
Bleaching powder, an impure commercial product manufactured in large quantities by modern electrolytic methods at Niagara and by earlier chemical methods in Europe, is now being used for disinfecting sewage. Owing to the fact that at Niagara it is a by-product of the much more important caustic soda industry, its present market price is low.

Upon mixing with water, it goes into solution only partially, a residue of carbonate of lime and an excess of free lime remaining in the tank as a white sludge. To the layman one of the most striking features of this process of disinfecting sewage is the relatively small amount of disinfectant necessary. For crude sewage an amount of so-called "available chlorin" equivalent to about 5 parts per 1,000,000 parts of sewage, which amounts to about 125 lb. of bleaching powder to 1,000,000 gal. of sewage, suffices.

The present market price of the bleaching powder is $25 per ton. So it will be seen that the cost of disinfectant is only about $1.70 per million gallons of sewage disinfected.

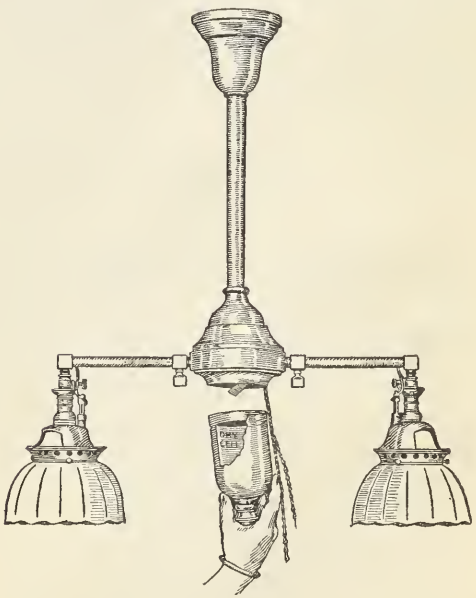
NEW GAS-LIGHTING DEVICES

Convenience in lighting is one of the favorable features in the use of electric lights that gives electricity a great advantage over gas for illumination. The manufacturers of gas and of gas fixtures are trying to overcome this by securing handy lighting devices. Two of the latest attempts are shown in the



Novel Ideas for Igniting Gas

accompanying illustration. One firm has brought out a device for lighting gas stoves and a smaller one for igniting the gas in lamps and automobile headlights. Another concern has placed on the market a fixture which contains a small dry battery which ignites the gas jet, a sharp pull on a cord operating it. A small piece of flint-like substance against which a piece of rough steel brushes, is the means of obtaining a spark in the former devices. The hood of the gas-stove lighter acts as

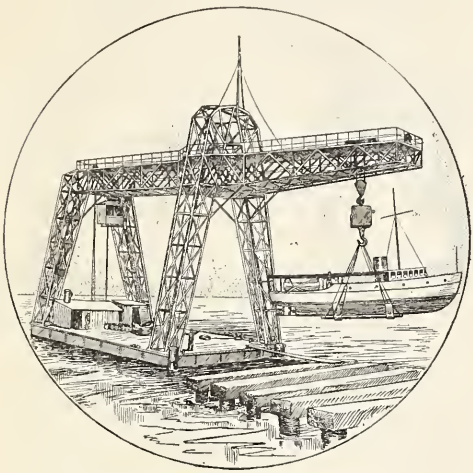


Dry Battery Ignites Gas Jet

a pocket for the gas and ignites it quickly.

FLOATING CRANE FOR HOISTING BOATS

The peculiar requirements of the docks at Danzig, Germany, caused the construction of the floating crane



German Floating Crane in Operation

shown in the illustration. It is provided with a water ballast chamber for off-setting the load which it hoists. The crane has a capacity of 60 tons. The hoisting engine and boiler installation is so mounted that the weight aids in balancing the load raised by the crane.

NEW METHOD OF STAGE LIGHTING

A Spanish engineer has developed a new method of stage lighting in theaters by means of which the glare of the ordinary arcs and clusters are done away with. He uses an arc lamp as the ordinary source of light, but the rays, instead of falling directly on the scene, are thrown against a series of silk bands, which are unrolled and set in any position by means of pulleys. The bands serve to reflect the light and diffuse it perfectly. The devices also include a sky, formed in a quarter of a sphere lined with a dead white coating. The diffused light is thrown into this dome and gives the illusion of unlimited space.

Still another arrangement forms clouds which have a more natural, less rigid appearance than the ordinary stage cloud. The result is secured by the use of mirrors, which reflect painted screens representing clouds. When the mirrors are rotated the clouds appear to be moving slowly across the sky.

BACK-REST FOR MOTORCYCLE SADDLES

Motorcycle manufacturers are gradually developing a new type of seat for motorcycles to take the place of the ordinary bicycle saddle, one new departure being a bucket seat not unlike the driving seat of an automobile, only smaller and lighter. But the ordinary motorcycle is still equipped with the saddle seat, and to make this more comfortable, the back-rest shown in this illustration has been introduced. It is attached to the frame of the saddle in such a way as not to interfere with the rider in dismounting, this being its chief feature. When the rider removes his weight from the saddle, the back-rest automatically falls backward out of the way, which it cannot do unless the rider's weight is absolutely away from it. To place it in position

Back-Rest for Motorcyclists

again, all the rider has to do is to lift it up until it clicks into the desired notch.

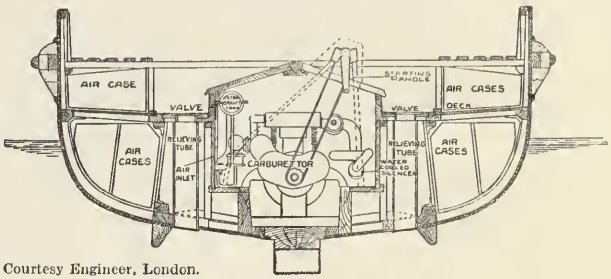
¶Noiseless paper for programs is being used in Germany.

MOTOR LIFEBOAT ENGINES

Many difficulties had to be overcome before the installation of gasoline engines in lifeboats proved successful, but for some time past both the United States and England have had several such boats in operation. The first requirement, of course, was the placing of the engine in a water-tight compartment. As it is often impossible to open this compartment for hours at a time in a heavy sea, the engine must be started, controlled, and run for an indefinite period out of sight.

In the English boats sufficient fuel and lubricating oil is available for a 12-hour run. Air is admitted to the carburetor by indirect communication with the atmosphere, so that the danger of flooding with water is eliminated. The air is drawn from the hold of the boat, through a large water-tight bend fitted inside the engine compartment. Air enters through valves fitted at the top of each end-box bulkhead, from which pipes are carried down to the hold.

The necessity of automatically stopping the engine when a self-righting boat tips over was met in the following manner: An automatic cut-out switch, fitted to the ignition apparatus, becomes operative when the boat goes over to a certain angle, and the engine stops. This is necessary because, when the boat goes over, the crew may be thrown out, and it would not be well if, on righting, it should run away and leave the men in the water. When the boat rights itself, one of the crew turns the crank and the engine at once starts again.



Courtesy Engineer, London.

Arrangement of Motor Lifeboat Engine

¶According to reports from Europe, His Holiness Pope Pius X has caused a phonograph to be added to the musical instruments in the Vatican. Records made by the famous instrumental players, especially of the violin, which he is said to admire greatly, are provided for his pleasure.

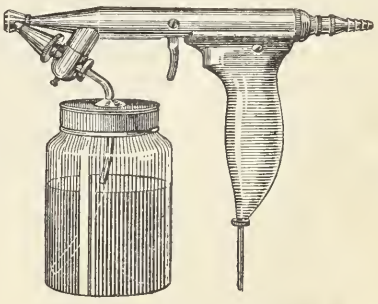
A TELEPHONE AT EVERY TEE

Telephones at every tee is the latest equipment for golf links in the middle west. The innovation was started by the officials of one of the golf clubs outside Chicago.

Many business men desire to play golf, and yet can ill afford to be out of direct reach of their offices for a couple of hours at a time. With a telephone at every tee, this drawback no longer exists.

PNEUMATIC PAINT "BRUSH"

The paint sprayer or "brush" as it is called, which is shown in the illustration, is in the nature of an improvement over the air brush which has proven such an advantage to the painting trade. By the attachment of a large receptacle for paint, it makes possible the continuous use of the brush over a large surface without the necessity of continual refilling. The paint is drawn up from the jar and thrown with a slight force against the surface being painted.

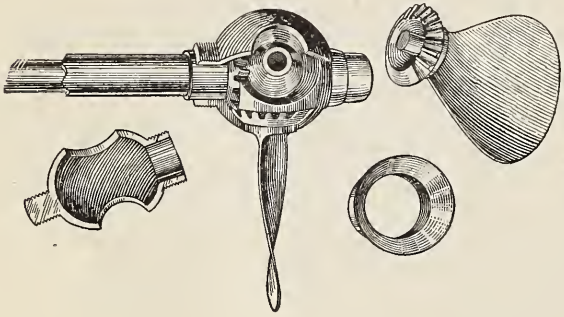


Paint Sprayer for Continuous Use

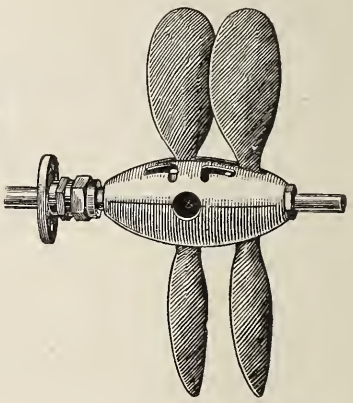
ADJUSTABLE MOTORBOAT PROPELLERS

Two propellers of interest to motorboat enthusiasts are shown in the accompanying illustrations, one being a double-acting reversible propeller, and the other a propeller with which the sleeve on the main shaft is rotated in reversing.

The other propeller is of an entirely different principle from that of the ordinary reversible propeller. The idea is that of rotating the sleeve on the main shaft instead of sliding through



Propeller Reversed by Rotating Sleeve



Double-Acting Reversible Propeller

The former consists of four blades set in a movable hub, and supported by four bearings. At positions of full speed in either direction these blades lie in parallel planes. When it is desired to change the speed, to decrease it, or reverse the direction of the boat, a lever is thrown in the desired direction. In reducing the forward speed of the boat the forward pair of blades turn so that they counteract the forward driving action of the rear set of blades and consequently diminish the speed. When the reverse lever is pushed to further reduce the speed, the rear pair of blades begin to change their pitch, and at neutral the two blades absolutely balance each other. When the backward driving force of the front pair of blades becomes stronger than the forward propelling force of the rear pair, the boat changes the direction in which it is traveling. During all the changes of speed, or at position of full stop, the propeller is still turning in the water at the same speed, and the same load on the engine is maintained constantly. Thus, engine racing is entirely eliminated, as the work is always the same.

the stuffing-box, as is the usual practice with reversible propellers. The drawing shows a three-bladed propeller with one blade removed, and one of the others turned in a neutral position for relieving the engine of a load in starting. The third blade is out of sight behind the hub.

HOW THE GOVERNMENT TESTS ITS COAL PURCHASES

The United States government buys about seven million dollars' worth of coal every year for use in the Navy, in public buildings in Washington and other cities, and for other purposes, about one-third of it—mainly coal used in public buildings—on specifications under which prices are fixed according to the value or quality of the coal delivered by the successful bidder.

A definite standard of quality for the coal thus purchased is specified by each bidder and this standard is considered in awarding the contract. If the value of the coal furnished is below the standard fixed, a discount is made from the

contract price; if its value is above the standard, an allowance is made for the excess of value and a proper sum is paid in addition to the contract price.

The value is determined by tests and analyses made by the geological survey on samples taken from the coal furnished by the contractor. These analyses and tests show the quality of the coal in terms of fixed carbon, volatile matter, sulphur, ash, and moisture, and especially its heating value in British thermal units, as determined by calorimetric tests.

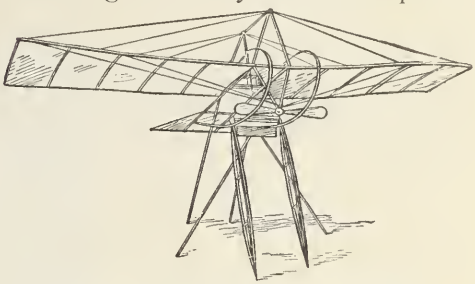
Until within a few years the agents of the government, in buying coal, relied upon the integrity of the dealer and the reputation of the mine or district from which the coal was obtained, and these formed the only possible assurance that the coal was equal in quality to the grade to be furnished. The new method has been so successful that it will probably be gradually extended to cover a larger share of the government's fuel supply.

The new plan has not yet been applied to fuel purchased for the vessels of the United States Navy, but does cover about 400,000 tons of coal bought for use on the Isthmus of Panama and about 140,000 tons used on steamers plying from New York to Colon.

LAUNCHING DEVICE FOR AEROPLANES

This launching device for aeroplanes created much interest at the last aero exhibition in England. It is a simple device, consisting of two or more pairs of stilts hinged to the frame of the aeroplane in such a way as to be out of the way in flying, but forming a support for the machine in starting. The aeroplane is raised upon the stilts by the lifting power of several attendants, or by block and tackle. Then the engine is started, and, when speeded up, the clutch is thrown, bringing the propeller into operation. The aeroplane, forced by the propeller, begins to fall forward, but before it can reach the ground sufficient speed is gained to keep it flying.

The device is designed to provide a launching means by which aeroplanes

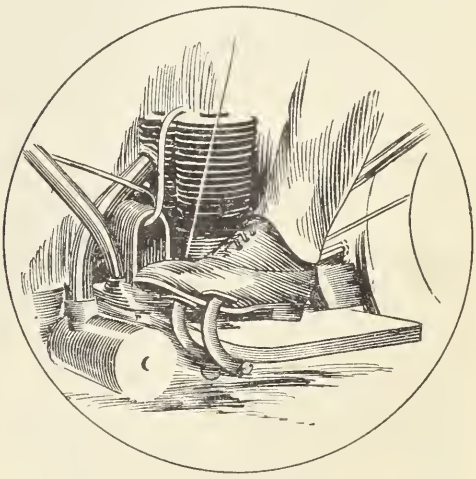


Stilts for the Launching of Aeroplanes

can be operated from rough ground without rails, towers, or even a preliminary run.

MOTORCYCLE WITH TWO-SPEED GEAR

Every year the designers of motorcycles adopt more and more the features of the automobile for the smaller vehicle. The application of the high and low gear principle to the motorcycle, controlled by foot pedals, is the latest acquisition. In trials which have been made with motorcycles thus fitted the double gear system has worked per-

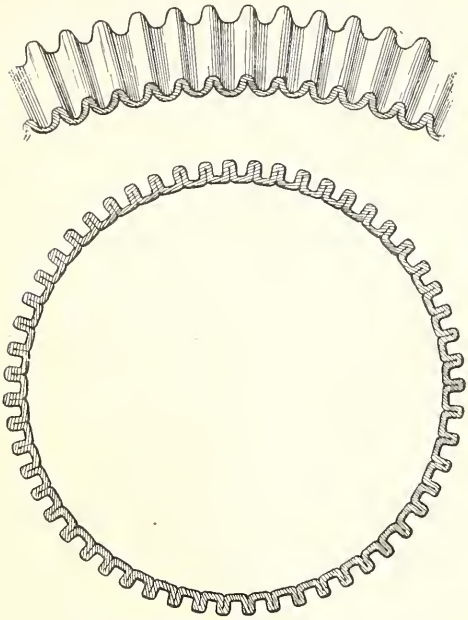


High and Low Gear Pedals on Motorcycle Footboard

fectly, and, it is reported, has added to the enjoyment of riding. The pedals are located on a footboard on the left side of the machine.

PRESSED STEEL GEARS

A new way of making gears is to form up teeth out of ribbons of steel. Bevel, spur and internal gears can be

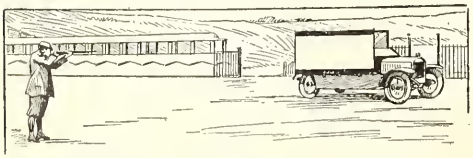


Teeth Formed Out of Ribbons of Steel

made by this new method. The rim with the teeth is secured to suitable arms or spoked hubs by welding or brazing. The teeth are not equal in shape to those that are cast, but they are stronger than the cast gears of equal weight.

AUTOMOBILE AS MOVING TARGET

The Brooklands track, which is England's finest motor speedway, is not only used for racing, but for automobile and auto accessory tests of all kinds. One



Shot Test with Moving Automobile

of the recent tests was to determine whether or not the charge fired from a shell at a moving target "strings." That is, whether the last shots, or the slower traveling shots, trail off like the tail of a comet.

A steel target plate, sufficiently long and high to protect the body of the car and its driver from injury, was mounted on one side of an automobile, which was run past the marksman at speeds of 30, 40, 50 and 60 miles an hour. No matter at what speed the car was traveling, there was not the slightest sign of the shots stringing, as in each instance they practically made a circle.

A shot from a gun travels at anything over 500 miles an hour, whereas a partridge, for instance, seldom flies at a speed of more than 40 miles an hour.

WORKMANSHIP IMPORTANT IN CONCRETE MAKING

The importance of good workmanship in mixing concrete is clearly demonstrated by a test made at the laboratory of the technologic branch of the United States geological survey. Three firms doing concrete work were asked to furnish gangs to mix and place concrete for cubes and test beams. The same materials were supplied to all three gangs, and the cubes and beams were tested under the same conditions.

The maximum variation between the test results was about 100 per cent, parallel specimens made by the laboratory employes testing to about the same strength as those of the gang securing the maximum results.

With a richer mixture the greatest difference in results was about 60 per cent, thus showing that an increase in cement tends to offset poor work to a considerable extent. The test beams were 13 ft. long, and were designed to fail under compression, so as to give a truer index as to the strength of the concrete.

¶A French association for the prevention of accidents is offering a prize for a safety automobile crank of improved design.

VISUALIZING THE ACTIVITIES OF THE MICROBE

With the use of the ultra-microscope in connection with the electric moving-picture machine, some remarkable results are being secured. The spectacle of microbes, enlarged 30,000 times, showing their activities in the human blood, will soon be thrown on the white screens of moving-picture theaters as well as before bodies of students. The moving-picture theaters have a great opportunity for increasing the interest of the public in scientific subjects, and they seem to be taking advantage of it. Presented in a clear and convincing manner, the wonders of nature are as interesting to the average person, as the comedies usually depicted.

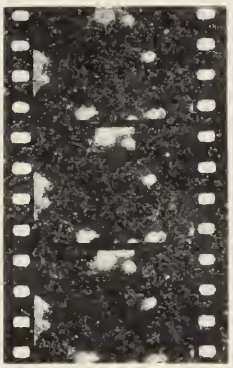


Fig. 3

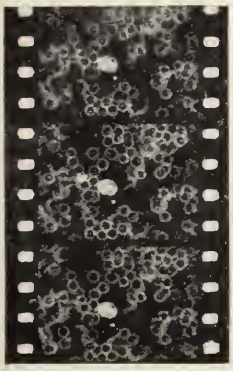


Fig. 1

The portions of films here shown are from some made by Dr. J. Comandon, of Paris, by combining the ultra-microscope with the moving-picture machine.

The accompanying illustration, Fig. 1, shows a negative taken on a French electric moving-picture machine with three pictures of a drop of blood indicating the position of the white and red globules and microbes at three consecutive exposures, while Fig. 2 shows a similar positive set of illustrations. The negatives, Figs. 3 and 4 show a drop of blood clearly indicating the movement of the microbes. The corkscrew appearing parasites and their rapid movements are clearly indicated in the negative film, Fig. 3, while other forms of microbes are indicated darting about like serpents among the healthy red globules of the blood.

The moving-picture machine flashes upon the screen consecutive pictures of these films at the rate of 16 per second and the movements of the living bacilli are faithfully reproduced. The white globules of the blood are seen attaching themselves to these bacilli, devouring and enveloping them.

By the use of the ultra-microscope many bacilli are now made visible which are not distinguishable from the white field of the ordinary microscope, the microbes themselves being transparent.

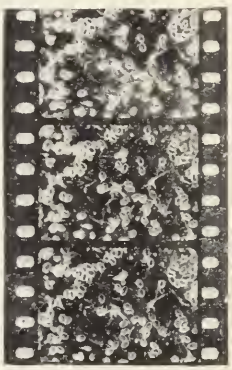


Fig. 2

In using the ultra-microscope with the moving-picture machine, a powerful light is thrown upon the subject from an electric lamp placed at one side of the apparatus instead of projecting rays of light through the object.

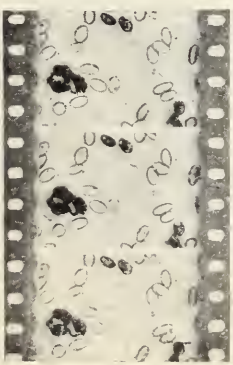


Fig. 4

The light is refracted in such a manner that none of the rays enter the tube of the microscope and the objects appear as bright spots on a dark background so that many new bacilli are made visible by this apparatus which could not be studied until the development of the ultra-microscope.

An electric arc lamp of several thousand candlepower taking a direct current of 30 amperes is util-

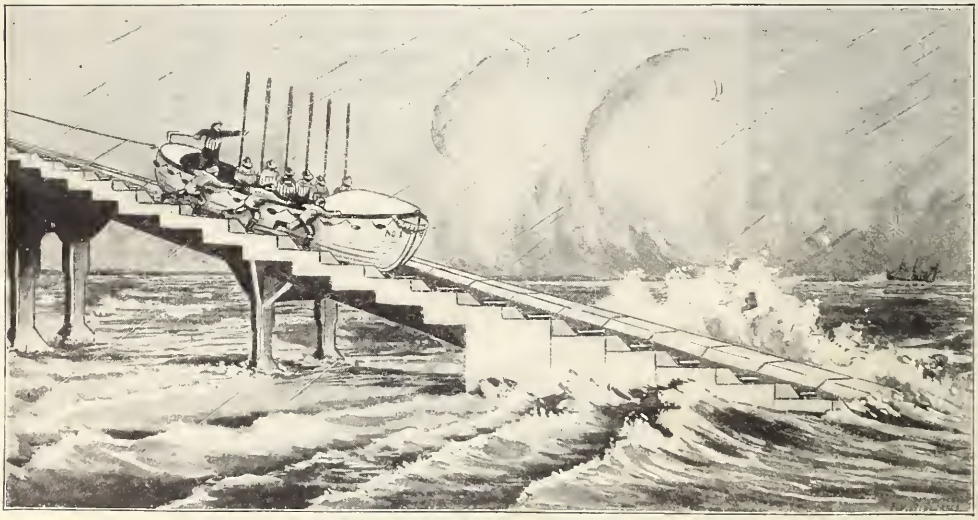
ized in connection with the cinematographic camera, the rays of the electric light being concentrated by a diaphragm and a series of lenses upon the objects, a moving disk being employed to cut off the light synchronously with the moving-picture machine so as not to overheat the objects photographed. The heat from the powerful light would kill the bacilli, were the exposure continuous. In addition to the reduction of heat by the successive exposures, each of a fraction of a second, the rays of light are also passed through a glass tank of cold water which absorbs much of the heat.

It is maintained that this remarkable combination of the moving-picture machine with the ultra-microscope can be utilized not only for studying rapid movements in microscopic animal life, but may also be employed for the investigation of the extremely slow movements of cell growth by the biologist.

The moving-picture machine can synthesize the very slow movement as met with in embryology by increasing the speed of the film producing the pictures shown on the screen, in the same manner that the rapid movements of the microbes are analyzed by the reduction of the speed of the cinematograph.

CONCRETE LAUNCHING WAYS FOR LIFEBOATS

An unusual example of concrete work has just been completed near Wick, in the north of Scotland, in the form of launching ways for the Ackergill life-saving station. Such ways have formerly been constructed of timbers or of rolled-steel sections, and the use of concrete is a new departure.



Concrete Launching Ways in Scotland

The ways consist of an elevated platform located well up on the shore and an incline runway leading out into deep water. The runway is provided with the necessary rolls and guides for the proper handling of the boats, and a series of steps for the use of the crew. The total length of the structure is 194 ft. and its width is about 16 ft. The end of the incline entering the sea is formed of a solid mass of concrete, while the remainder is made up of reinforced beams, columns and slabs. Open construction is used on the incline so that the smallest possible resistance will be offered to heavy seas.

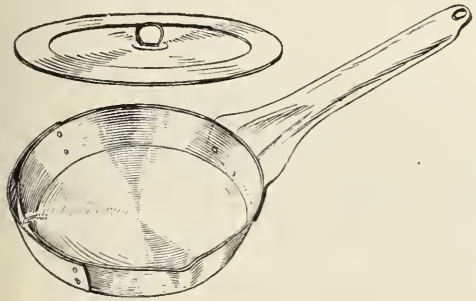
STEEL BANDS FOR POWER TRANSMISSION

Steel bands for power transmission are rapidly coming into use, according to a German magazine. Count Zeppelin has adopted such bands in place of leather belts for the driving of the propellers of his airships, and many electrical concerns are experimenting with them.

The advantages of the steel bands are the small elongation compared with leather belts, ropes, and other methods of driving, and the impossibility of the slinging noticed with loosely mounted belts. Differences in temperature and moisture have no appreciable effect on steel bands, and the width of such bands need be only about one-fifth that of a belt for the same purpose.

SMOKELESS FRYING-PAN

A frying-pan, said to prevent smoke and odors from emanating from the food being cooked, even onions being included, has been placed on the market. One side of the wall of the pan, as can be seen in the illustration, has an extra section of wall attached. At this point the inner wall is cut low, and between the two is an opening. With the cover in position on the pan the natural draft of the cooking range starts a circulation through the pan

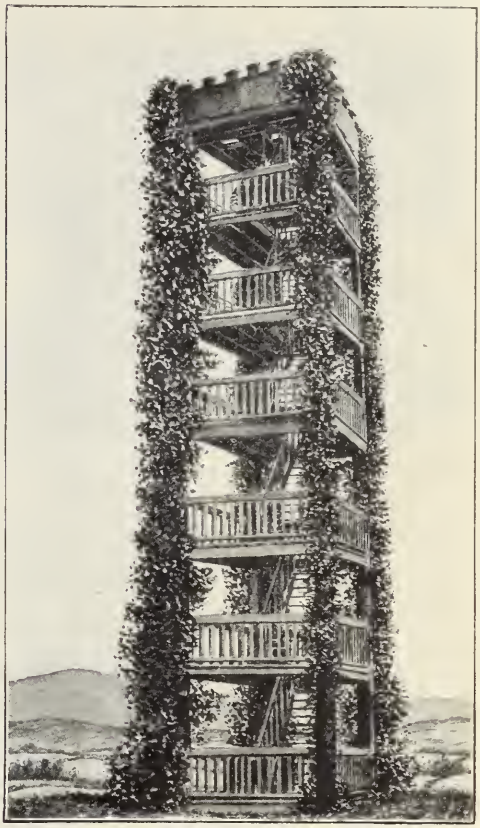


Smokeless and Odorless

and over the food being cooked, this circulation drawing all smoke and odors down into the fire chamber.

A LIVING TOWER

Rising 100 ft. above the top of a hill, which is itself 300 ft. above the surrounding country, in Sonoma county,



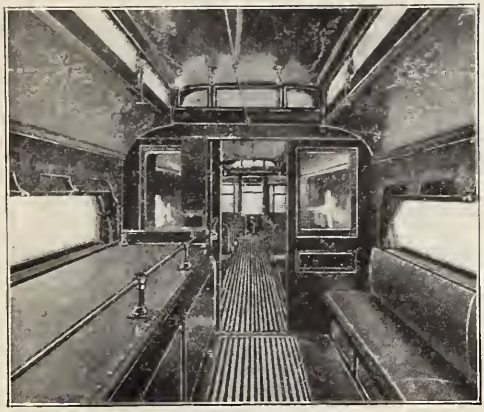
Growing Tower in California

California, is an observation tower unique because it is "alive."

The supports of the tower, which is said to be the only living one in the world, are young redwood trees. These trees, all of about the same size and growing in such position that they form an almost perfect square, were originally about 150 ft. high, but the tops were cut off to form a support for the upper platform. The tower is divided into six stories, the floor of each resting on beams anchored to the tree trunks by steel cables and bolts. Stairways lead from floor to floor, and a view of the surrounding country for many miles can be seen from the top.

FUNERAL CAR OF CHICAGO CITY RAILWAY

This very complete funeral car is one of two specially constructed for the use of the Chicago City railway on



Interior of Funeral Car

one of its south side lines It is 43 ft. long and has two sections, one of which is for the casket and pallbearers and the other for the mourners.

The most interesting feature of the arrangement of the car is the casket compartment, which opens from the outside, as shown in one of the illustrations. A panel or horizontal door, which appears as part of the wooden body of the car when closed, drops down and is supported by chains. The inside of this door and the floor of the casket compartment are fitted with rollers for the carriage on which the casket is placed. The compartment is also accessible from the inside of the car by means of a removable panel.

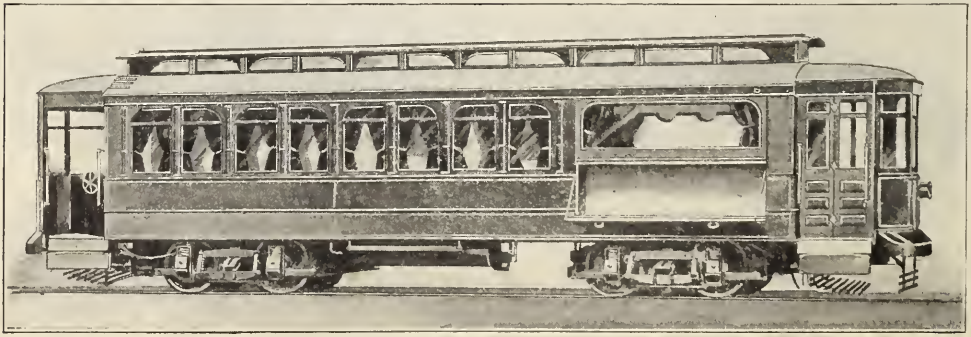
The section of the car containing the casket compartment is lighted by two long windows, that on one side being over the casket compartment, and the other being over the side seat just opposite, for the pallbearers.

SAFE MADE SPECIALLY FOR RADIUM

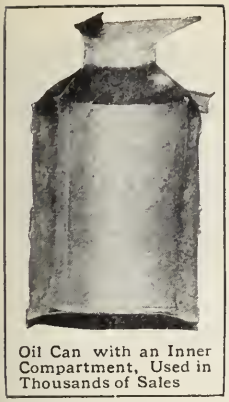
A most ingenious safe has just been completed for the British Radium Corporation as a receptacle in which to store the precious substance. The problem presented to the makers of the safe was not only to provide a strongbox that would be burglar proof, but which at the same time would prevent the escape of the radium. Radium emanations will pass through the thickest and hardest steel, consequently the inner coffer of the safe was made of lead, 3 in. thick, inclosed within a burglar-proof steel shell. One of the special features of the safe is the means of collecting the radium emanations before the coffer is opened.

The total weight of the safe is 3,000 lb., and it is designed to hold 100 lb. of radium, should that great amount, valued at billions of dollars, ever be produced.

¶Three firemen were killed in Macon, Ga., recently, and an auto fire engine wrecked, by the bursting of one of its tires while turning a corner at high speed.



Exterior of Car Showing Open Casket Compartment



Oil Can with an Inner Compartment, Used in Thousands of Sales

SWINDLING THE POOR WITH FALSE WEIGHTS AND MEASURES

Trick Measure that Cut the Contents Down More Than One-Half

PILED high against the wall of one of the rooms in the headquarters of the New York Bureau of Weights and Measures there rests the most amazing evidence of the trickiness of the small merchant and the push cart peddler ever collected in one city. For years this department has waged ceaseless warfare against the short weight frauds among the small dealers, and a mass of interesting relics can be seen in the department's museum, showing how clever the street merchant is in tricking his customer with false weights and scales. But the trick measure has not been used in a sufficient number of cases to justify a general raid for the purpose of running these rascals out of business permanently.

Frank McCoy, Acting Chief of the New York Bureau of Weights and Measures—He Is Holding a Ruler to Show the Real Depth of a Trick Pail

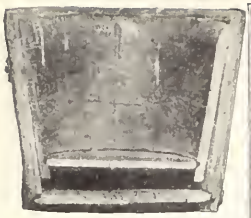
Recently it was decided by Frank McCoy, acting chief of the Bureau of Weights and Measures, to start a crusade on this particular line of unlawful endeavor. The result of this raid astonished even the inspectors of the department, who are used to every kind of fraud perpetrated by the push cart men and small dealers.

The most audacious swindle unearthed is illustrated in one of the accompanying pictures, in which Mr. McCoy is shown holding a rule in the interior of a pail with the falsest of false bottoms. The bottom of the pail extended only a few inches from the top. Even when dealing with the unsuspecting customers among the foreign element on the East Side, where this trick pail was seized, it would be palpably impossible to palm off a quantity of potatoes so short of the apparent measure as this false measure would be. The dealer realized that and success with the fraud depended almost entirely on his own ability to browbeat the customer. The pail of potatoes, apparently a full pail of ordinary size, would be placed on view, marked at so much the pailful. When the purchaser bit on the bait and bought the "pailful," there would of course be a row when it was found that it was about a fourth of what the contents of the pail seemed to be.

"But" said the dealer, "I sold you the contents of the pail. If you thought the potatoes went to the bottom it was your fault and not mine. All you get is what the pail held."

The trick it seems, is a common one and the victims are always the very poor.

The poorest of the poor are also the victims of the coal pail swindle. One of the illustrations, a pail photographed when cut through the middle, shows



Pail Within a Pail; Small One Jammed into Larger One

A Double Basket Which Cuts Down the Apparent Contents One Half

This Held a "Bucketfull" of Coal; Note V-Shaped Compartment.

that the inner compartment is V-shaped, and cuts the contents down about a third. This was used by a dealer who sold coal by the bucketful. By quick work he could always hide the fact that it had a false bottom, pouring the contents into the customer's basket, and quickly slipping the empty pail out of sight.

Of dry measures seized there was an almost unlimited number. One of the most flagrant cases of fraud is selected for illustration. It seems strange that such an obvious swindle should have been possible of accomplishment, for the measure held less than half the quantity its exterior would indicate. This measure was used by a push cart peddler who sold peanuts and other small dry commodities.

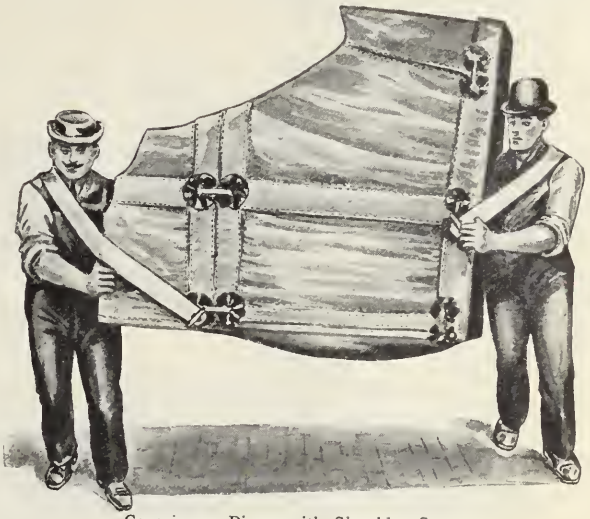
A 5-gal. oil can seized had an inner compartment that must have helped considerably to swell the receipts of the small dealer who devised and used it. This swindle was an easy one, for who among the customers would measure out the oil to see whether or not the dealer had furnished five gallons or only four and a half?

In the immense quantity of sales made through a small pint dipper the tricky dealer at whose place it was seized must have reaped a harvest of pennies of the poor. He had cut down the dipper from the handle, doing it gradually so as not to make the operation too obvious, but cutting it so thoroughly that when the trimming had reached the outer edge the dipper was far from being full measure. This dipper had been in use in all probability for months before the inspectors pounced upon it, and in all that time the poor of the neighborhood who made their purchases by the dipperful had been victimized on every trade.

"It is difficult to prosecute these crooked tradesmen," said Mr. McCoy. "They hide behind so many subterfuges. The ignorance of the people upon whom they prey is the chief reason why we cannot send the short-weight man to prison. The push cart men do not call their false measures by the name that the contents call for according to the exterior appearance of the measure. They cover the trickiness of the deal by marking their false measures in general terms and the deception nine times out of ten is not noticed by the customer. We relieve the public as far as we can of these swindles by seizing the crooked devices and short measures. Some day a law will be passed that will deal with the cases more specifically."

HEAVY PIANOS CARRIED BY TWO MEN

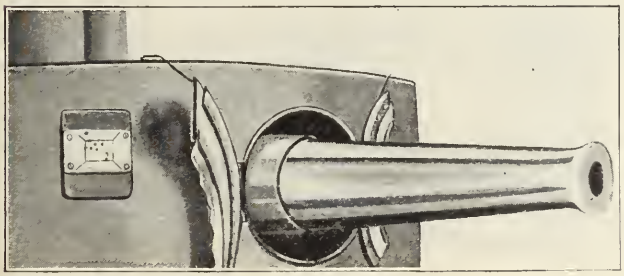
A novel method of carrying heavy grand pianos has been adopted by the piano movers in Germany. It usually takes three or four strong men to carry a grand piano safely, but by means of a novel device, which includes heavy leather shoulder straps on which the piano is supported, two men can do the work. After having taken off the legs of the piano, the carriers screw T-shaped bolts, 1 in. in thickness, into the runs, one on each side. A leather carrier belt is thrown over the cross-bars of these bolts, and the loop of the belt, as shown in the accompanying illustration, is thrown over the shoulders of the carriers. The body of the piano has previously been wrapped in a canvas provided with several belts and clasps. The heaviest piano is thus transported with comparative ease by two men of average strength up or down any number of stories, quickly and safely.



Carrying a Piano with Shoulder Straps

WRECK RAISED BY COMPRESSED AIR

The attempt to raise the steel steamer "Fleswick" which sank in the harbor at Cork, Ireland, as the result of a collision, was successfully carried out by the compressed air method. The vessel, which was 128 ft. long, rested on her side in 27 ft. of water. The coal forming her cargo was first removed, and the hull was then made as nearly tight as possible by closing the hatches with steel plates, placed by divers. Air was then pumped in, and after considerable trouble, the ship was floated.

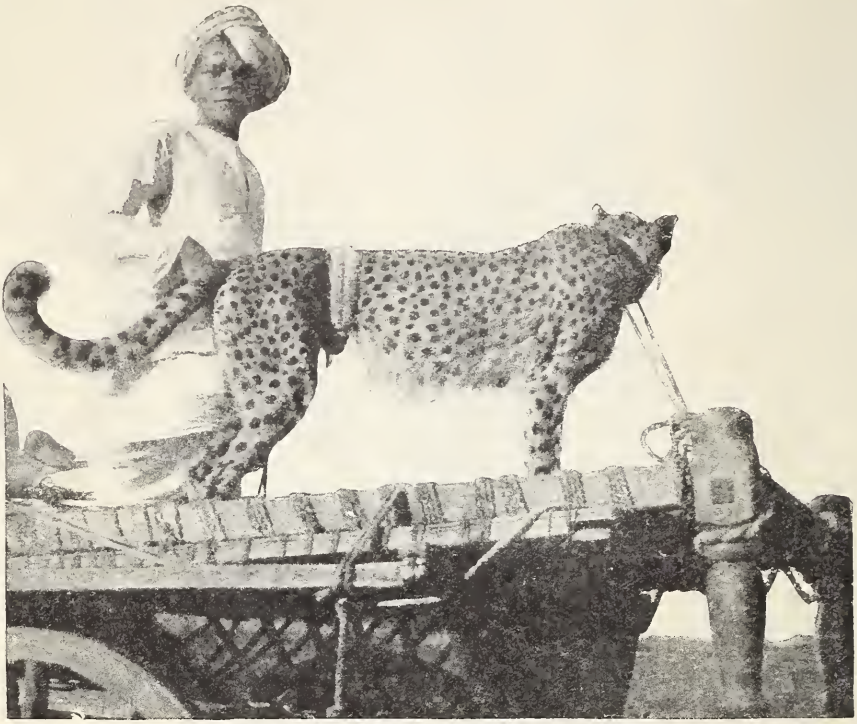


Recording Extraordinary Target Hits

FAMOUS TARGET HITS REPRODUCED IN BRASS

Following the method of marking buildings and articles of historic interest by attaching brass information plates to them, the officers of the H. M. S. "Natal" have caused to be attached to each gun little facsimiles in brass of the target hits made in record tests.

The H. M. S. "Natal" secured the coveted honor of being the crack gunnery ship of the British navy in the 1909 tests. The brass plates showing the hits of the gun, to the barbette of which it is attached, also bears the names of the gunners.



Trained Cheetah Being Conveyed to the Hunt

CHEETAHS TRAINED FOR THE HUNT

Trained cheetahs are used in Persia and India in much the same manner that hounds are used in European and North American countries. The game they are used to hunt is principally deer and antelope. The cheetah is an animal with black and brown spots, resembling a leopard, but longer in body and limb.

The Indian princes keep packs of them for the hunt. The heads of the hunting cheetahs are usually covered with a hood until within 200 yd. of the game. The hoods are then removed and the animals creep stealthily towards the herd, and, having approached as near as possible, pounce upon their prey, killing with one blow of the paw. If unsuccessful, the cheetah does not attempt to give chase to the herd, but slowly, as if ashamed, creeps back to the hunters. The tamed cheetah is said to be a very docile and companionable animal, despite its fierceness in the hunt.

THE BLIND AS MASSEURS

Massage, practiced by the blind for more than 1,000 years in Japan, is proving an ideal occupation for the blind in America, and the number of blind masseurs is rapidly growing. Professor Yoshimoto, principal of the Model College for the Blind in Tokio, recently visited the United States. He is very enthusiastic as to the employment of the blind as masseurs and urges that they be trained for the profession. The blind masseur has proved very satisfactory in Japan, and, according to Professor Yoshimoto, is highly appre-

ciated by both doctors and patients. Almost all the blind in Japan are masseurs, and until recently they possessed special privileges in that country. The students spend from three to five years at the school, first obtaining a general knowledge of anatomy, physiology, and pathology. Then they study massage and the ailments it cures. The blind develop a more sensitive touch than persons with sight, and soon train the fingers to rapid and skilful movements.

The blind Japanese masseurs also have many ingenious methods by which they can well make up for the deficiency of sight. Though they cannot see the expression of their patients' faces, they can observe them just as well by lightly feeling certain muscles in the face. Thus, they can determine whether the treatment is strong or weak.

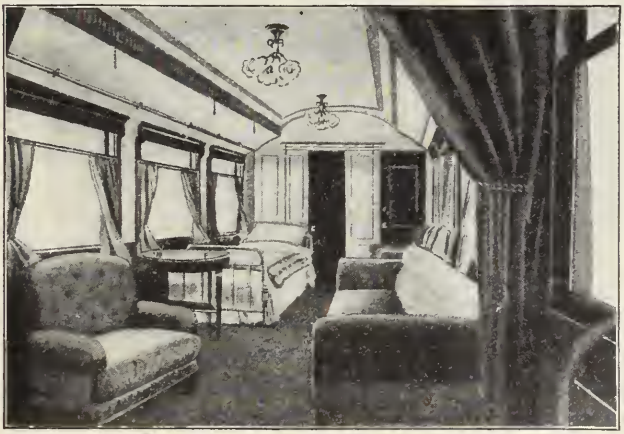
RAILROAD WRECKER TRANSPLANTS FIVE-TON PALM

The Southern Pacific railroad found it necessary recently to remove its depot at Roseville, Cal., to a new location. The depot was an especially pretty one, one of the features of its surroundings being a palm about 35 ft. high which was growing within 10 ft. of the structure. The company did not want to lose the beauty of the palm as an adornment for the depot grounds, so moved the palm also. This was accomplished in a novel manner.

Gardening with a Wrecker

A large quantity of earth was excavated and loosened and the big tree which, with the earth clinging to its roots, weighed about 5 tons, was lifted from its resting place by a railroad wrecker, was moved about 400 ft. and set back into the ground again.

INVALID CAR ON ENGLISH RAILROAD



Railway Car for Invalid

One of the latest and most interesting acquisitions to the rolling stock of the Great Northern railroad of England is an invalid car for the use of people who can afford such luxuries. The car has two first-class corridor compartments, the invalid compartment, attendants' and luggage compartments, and two toilet compartments. The invalid compartment, which is shown in the illustration, occupies the middle of the car, so as to clear the resting bed well from the trucks. Besides the bed, this compartment is furnished with a couch, settee, and several easy chairs.

ARTISTIC CONCRETE BUILDINGS
No. 10, Residence of Dr. W. Wesselhoeft, Cambridge, Mass.

HEAT

Part VII—How Heat Is Measured

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[This is the seventh article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. The following subjects were discussed in the months indicated; February, "The Nature of Heat and How It Is Measured;" March, "How Low Temperatures Are Produced;" April, "Some Effects of Low Temperature Upon Matter;" May, "The Production and Uses of High Temperature;" June, "High Temperatures and the Rare Metals;" July, "How Heat Travels." Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

A THERMOMETER tells us the degree of temperature, but it does not tell us anything concerning the quantity of heat that may be in a body. A pint of water at 10° C. is much cooler than an ounce of water at 80° C. but the pint contains more heat than the ounce. To attempt to estimate the heat of a body by its temperature would be just as absurd as to estimate the size of a river by its velocity without considering its volume. In that case a mountain brooklet would be larger than the Amazon, and a fast running creek would be greater than the Mississippi.

Heat is measured by reference to some standard unit just as silk is measured by the yard, butter by the pound, or milk by the quart. Many different kinds of heat units have been suggested, but the most common, and the one most easily understood and most generally used in engineering practice is known as the British thermal unit, abbreviated as B. t. u. A British thermal unit is the amount of heat required to raise one pound of water one degree Fahrenheit. This is the yardstick of heat, and by its use we are able to estimate the quantity of heat in a pound of fuel, or to determine the ratio between the heat values of different substances just as easily as the grocer weighs out his sugar, or the draper measures off a definite length of calico.

As has been indicated, water is taken as the standard for the measurement of heat just as it is taken as the standard of specific density. A cubic inch of gold weighs 19.6 times as much as a cubic inch of water. We therefore say that the specific density of gold is 19.6. Even as we find that different substances such as gold, silver, copper, zinc, tin, and so forth, have different densities as compared with water, so we find that all substances

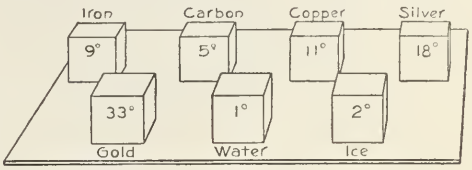

FIG. 1

Equal Weights of Different Substances Showing Degrees of Temperature Each Would Rise While Water Rises One Degree

have peculiar and distinct capacities for taking up this curious motion known as heat. A pound of iron, for example, at a temperature of 100° F. contains more than three times as much heat as a pound of gold at 100° F. and only one-ninth as much heat as a pound of water at the same temperature. Why is this? Again we are compelled to admit that we do not know. Even as some bodies are much better conductors of heat than others, so some bodies have a greater or lesser capacity for absorbing the vibrations which constitute heat. In Fig. 1 is shown a number of substances on a hot plate, all weighing the same amount and receiving the same quantity of heat. The cubes of course would not all be the same size, but are made so for convenience. The number placed on each cube indicates the degree of temperature to which it would rise while water rises one degree. The ratio between the amount of heat required to raise the temperature of a body one degree, and the same weight of water one degree is known as specific heat, and it is useful sometimes to know how to make this calculation. The operation is exceedingly simple, and depends upon the

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fact that when two bodies of different temperatures are placed in thermal contact, there will be a heat exchange exclusively between the two bodies, and the one will lose what the other gains. For example, suppose we wish to determine the specific heat of some new alloy. First determine its weight and temperature; then place it in water of known weight and temperature. In a short time the alloy and the water will have the same temperature. If the alloy was colder than the water its temperature would rise, and the temperature of the water would fall, and vice versa. The quantity of heat remains the same after the mixture as before. It is the relative amount that each substance rises or falls in temperature that tells the tale. If the alloy weighs one pound and the water the same, and the temperature of the alloy falls one hundred degrees, while that of the water rises five degrees, then 100 degrees of the alloy equals five degrees of the water, and we know the specific heat of the alloy is just one-twentieth of that of the water. The outline given below is a convenient form in which to express the facts stated above.

WATER		ALLOY	
Amount taken	1 lb.	Amount taken	1 lb.
Degrees of change	5	Degrees of change	5
Specific heat	1	Specific heat	X

5 = 100 X
.05 = X = Specific Heat of Alloy.

In a former article mention was made of "latent" heat as it was termed by the early philosophers. Let us review our knowledge of it. Latent heat is a form of energy, locked up as it were within certain bodies, such as water and steam. If ice be placed in a pan of water the thermometer will show a temperature of 32° F. Put the pan on the fire, the temperature of the water and ice will not rise but will remain at the freezing point until all the ice is melted. Let the water remain on the fire. Steadily the temperature will rise until the boiling point is reached, and there it will remain until the water is all evaporated. The heat given to the mixture of water and ice without changing the temperature was utilized by the ice in its transformation into water. Ice at the freezing point, plus sufficient latent heat, equals water at the freezing point. Likewise the heat given to the water at its boiling point was utilized in the actual work done in changing water into steam. Water at the boiling point, plus enough latent heat, makes steam. Conversely when water freezes or steam condenses, this energy, which has been locked up, reappears as "sensible" heat. Latent heat is most conveniently measured by the "mixture" method. For example, suppose it is required to determine the latent heat of water. This is done by adding water of known weight and temperautre, to ice of known weight and temperature. Water at 32° F. added to ice at the same temperature will have no effect upon the ice. If the water be warmer, some or all of the ice will melt. Add, say a pound of water, at 112° F. to a pound of ice at 32° F. The ice will melt, and the temperature of the mixture will be 32° F. In other words, the 80 degrees lost by the water is the price paid to the ice to liquidate or to go out of business and become water. The latent heat of water is therefore 80 thermal units, since as before stated, a British thermal unit is the amount of heat required to raise one pound of water one degree Fahrenheit, and the pound of water fell 80 degrees or in other words gave up 80 thermal units in converting the ice into water. The latent heat of steam is also easily determined. Water is boiled in a suitable vessel and the resulting steam passed into cold water whose temperature and weight are known. The steam will be condensed by the cold water, whose weight and temperature will thereby be increased. The added weight represents the amount of steam condensed. The rise in temperature represents the heat set free by the change from steam to water. Suppose the initial weight of the cold

water was one pound. Its added weight is one ounce; its increase in temperature is 33½ degrees. If an ounce of steam will heat a pound of water 33½ degrees, equivalent to 33½ heat units, a pound of steam would set free 16 times that amount, or 536 heat units, the latent heat of steam. Of course this is only a rough calculation, as several minor factors must be taken into consideration in a calculation of this nature, but the method outlined will serve to give a general idea of how steam is compelled to tell us some of its secrets. As a general thing heat causes bodies to expand. And now comes another curious fact, the reason for which we do not know. No two bodies have precisely the same rate of expansion, iron has one rate, gold another, aluminum another, and so on down through the list. Figure 2 represents the action of heat upon two equal strips of iron and brass riveted tightly together. The Bunsen flame will soon cause the compound rod to bow, the brass side being convex, as brass expands more than iron. Advantage is taken of the unequal expansion of different substances in the construction of the grid-iron pendulum, in thermometers, thermostats, and the balance wheel of a watch, the consideration of which will be deferred to a later article. The same substance, however, always expands at the same rate, and it is of great importance sometimes to know precisely the amount of expansion of a given metal at a given temperature. The method of determination is easily understood. A rod of iron, say, is carefully measured, its length being determined to the thousandth of an inch, and its exact temperature noted. The rod is placed in a jacket around which steam at 212° F. is caused to pass. Suppose the rod is 3 ft. in length, and its temperature 62°F. When placed in the steam it will of course become 212° F. a rise of 150 degrees. The rod is again carefully measured. The increase in length is due to the 150 degrees. Divide the increase by 150, and the amount of expansion caused by one degree will be known. Divide this answer by 3 (the length of the rod being 3 ft.) and the amount of expansion of one foot of iron for one degree of temperature,

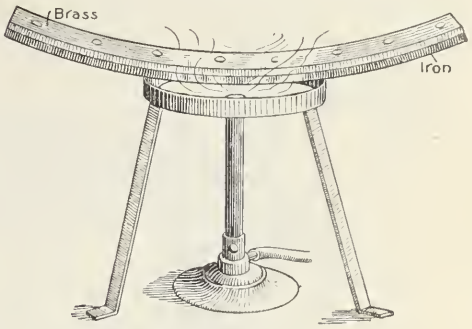


FIG. 2

Experiment Showing the Unequal Expansion of Iron and Brass

will be known. This number, which, in the case of iron is .000012 inches is known as the coefficient of linear expansion. In laying the rails of a railroad, the expansion of iron in summer and its contraction in winter must be taken into account. A blacksmith slips a red-hot tire over a wheel, and the tire is on to stay, as the subsequent shrinking makes a perfectly tight fit. A machinist shrinks a metal collar on a frame in the same manner, the pressure due to contraction being enormous.

And now we come to the consideration of the relation between heat and work. Everyone knows that hammering a nail will make it hot, but few people know that there is a direct numerical relationship existing between the amount of work done and the quantity of heat produced. Until the close of the eighteenth century heat was believed to be a fluid. Practically every scientist of note up to that time, with the exception of a few men such as Bacon, Locke, and La-Place, thought that the reason mercury occupied more bulk when heated was on account of an invisible fluid which permeated the mercury and caused it to expand. In 1798, Count Rumford noticed that the chips of steel resulting from the boring of a

cannon in the military workshop of Munich, were so hot that he could not hold them in his hands. This puzzled Rumford as he could not reconcile the

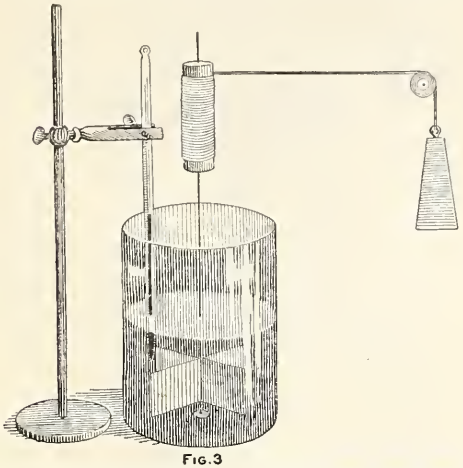
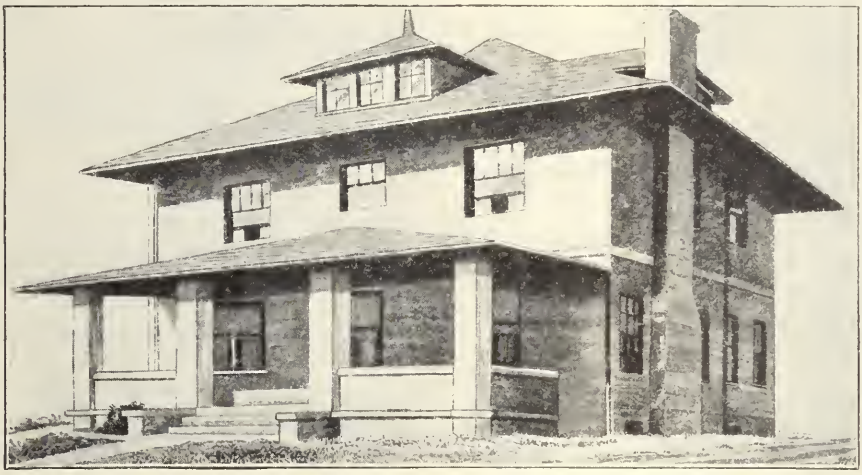


FIG.3
Apparatus with Which Dr. Joule Found Mechanical Equivalent of Heat

theory that heat was a fluid with the fact that both the cannon and the chips were extremely hot, and that the heat had obviously arisen from the friction of metal upon metal and not from the advent of some unexplained fluid. While Rumford was trying to solve the puzzle, Davy, over in England, demonstrated that two pieces of ice rubbed together in a vacuum would produce heat enough to melt the ice. Obviously the heat could not have come from the ice, and it could not have come from the air, as that possible source had been eliminated. Whence, then, did it come? Rumford thought it was produced by friction, and in order to demonstrate the truth of his theory, secured a large piece of brass hollowed out at one end, and fitted into it a cylinder of steel weighing 5 tons. By an ingenious mechanical contrivance attached to the cylinder, the latter was made to revolve within the brass 32 times in a minute. Water was placed in a box around the brass, and at the end of two hours and a half the water actually began to boil. Work had been transformed into heat without the shadow of a doubt. This experiment of Rumford's was a death-blow to the theory that heat is a fluid, and was the foundation of the belief that heat is a form of motion. It was a good start on the road to the truth, but even Rumford and Davy did not suspect that there is an exact relationship existing between the heat evolved from friction and the amount of work done. Almost 50 years elapsed before this was determined. In 1843, Dr. Joule of Manchester, England, performed his classic experiment, which revealed to the world the mechanical equivalent of heat. Figure 3 is a diagrammatic representation of the simple apparatus used by Joule in his demonstration. A paddle was made to revolve with as little friction as possible in a vessel containing a pound of water whose temperature was known. The paddle was actuated by a known weight falling through a known distance. A pound falling through a distance of one foot gives a foot pound of energy. At the beginning of the experiment a thermometer was placed in the water, and the temperature noted. The paddle was made to revolve by the falling weight. When 772 foot pounds of energy had been expended on the pound of water, the temperature of the latter had risen one degree, and the relationship between heat and mechanical work was found. Joule tried the same experiment again, using mercury instead of water, and verified his original discovery again and again. And what in plain language does this discovery mean? Simply this; the amount of energy required to raise a pound of water one degree Fahrenheit is sufficient to raise it 772 ft. against the force of gravity. Later determinations have shown that the correct figure is 778. One British thermal unit equals 778 foot pounds. The importance of this discovery cannot be overestimated, as it is the basis of practically all the calculations so essential in engineering practice relative to the construction of engines, and the determination of their capacities as regards the work to be done.

HOUSE OF CONCRETE AND SEWER TILE

Ordinary conduit or sewer tiles, which had been rejected for conduit work because of slight flaws, form the body of this concrete house in Wilmette, Ill. The foundation is built of four-way tiles with a 6-in. solid concrete wall on the outside. Above the foundation 5-in. one-way tiles were used with a monolithic concrete wall of about 4-in. thickness built against them on the outside.

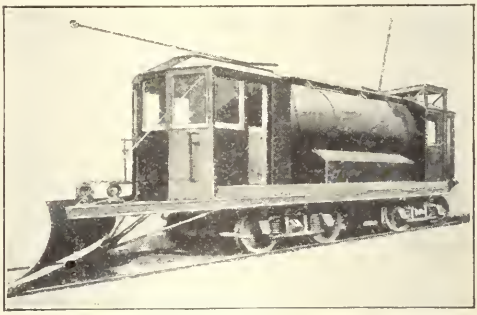


Sewer Pipe Forms Frame of This House

The tiles were first laid up roughly in cement mortar. Forms were then built up on the outside and concrete poured in, the tile wall itself forming the inner form. The walls inside were plastered directly against the tiles. Secured at a very low cost the tiles proved very satisfactory for the work.

STREET CAR SERVES AS FIRE ENGINE, SNOW PLOW AND LOCOMOTIVE

A combination car of unusual design, which can be operated as a snow plow, a sprinkler, a fire extinguisher, sand car, line car or locomotive, has just been put into service by an Illinois railway company which operates both steam and electric trains, and carries freight as well as passengers. The car has an overall length of 45 ft. when operated as a snow plow, and an overall length of 33 ft., 6 in., when the plow attachment is removed. The tank on the car has a capacity of 5,000 gal., and when used as a sprinkler, water is sprayed out by an air pressure of 20 lb. This air supply is derived from a compressor having a capacity of 90 cu. ft. The air is compressed to a pressure of 90 lb., after which it is reduced by means of valves, to a pressure of 20 lb., at which it is fed into the tank. When the car is to be used for fire protection the air is fed into the tank at a pressure of 40 lb., which enables it to throw a stream 100 ft. into the air. A cab is located at each end. The car weighs about 112,000 lb. when used as a locomotive.



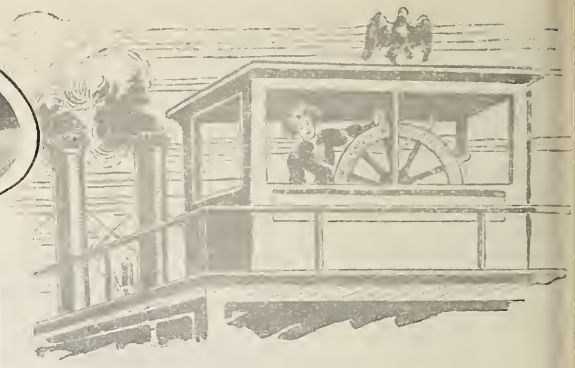
A Versatile Street Car

A River Captain for 20 Years

A WOMAN STEAMBOAT CAPTAIN

The woman shown in the accompanying illustration holds the novel distinction of being the only woman boat commander ever licensed by the government to command and pilot river steamers on the Ohio, Little Kanawha, and Mississippi rivers. She is Captain Mary B. Green, wife of Captain Gordon Green, owner of the line of steamers bearing his name.

Mrs. Green began her river life 20 years ago while still in her teens and a bride of only a few months. Unwilling to be separated from her husband she took up his life, and finally became commander of the Str. "Greenland," making trips from Cincinnati to Louisville. She also navigated the vessel on one trip between Pittsburg and St. Louis. One spring the steamer was



torn from her moorings and caught in the ice floes in the Little Kanawha river. Two of the crew jumped overboard in their fright and were drowned, but the woman navigator succeeded in saving the steamer from being ground to pieces by the ice.

AMATEUR WIRELESS PLANTS AS LIGHTNING ATTRACTORS

The most important reason advanced in the past couple of years for the government regulation of the thousands of amateur wireless telegraph installations springing up in every part of the country was due to a desire for supervision, so that the atmosphere should not become unduly clogged with aerograms.

Another reason has now developed, however, through the claim that the installations are dangerous lightning attractors, not only jeopardizing the residence or other buildings upon which they are erected, but also adjacent buildings. The board of underwriters of Chicago has issued the following requirements for wireless installations:

"The aerial conductor must be at least No. 8 B. and S. gauge rubber-covered wire, run on petticoat insulators on exterior of building and on knobs, cleats, or in moulding in interior of building. Porcelain bushings to be used through walls, partitions, and floors. Aerial conductor must be permanently and effectively grounded at all times when station is not in operation, by a conductor not smaller than No. 4 B. and S. gauge rubber-covered copper wire run as nearly

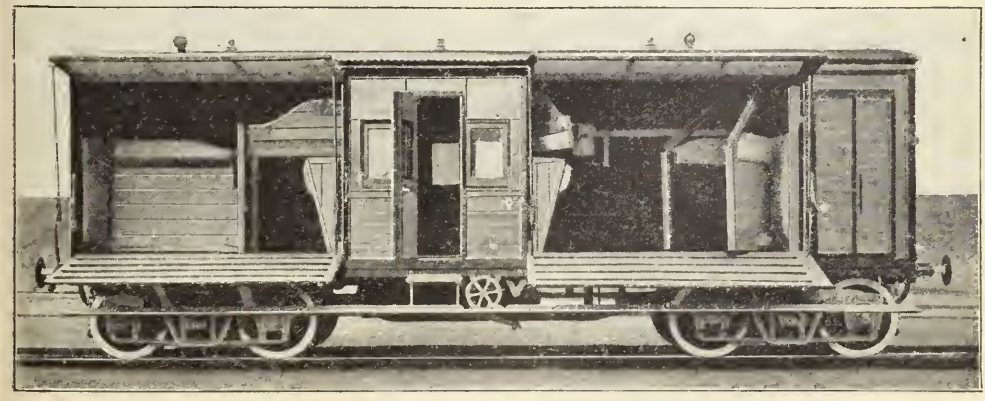
in a straight line as possible to a water pipe at a point on the street side of all connections of said water pipe within the premises, or to some other equally satisfactory artificial earth connection, such as an iron rod or pipe driven at least 5 ft. into the ground. The ground wire should be protected from mechanical injury by inclosing it in moulding at least 7 ft. from the ground on exterior of building. The switch employed to join the aerial to the ground connection must be an approved 100-ampere, single-pole, double-throw knife switch placed as near as possible to where aerial enters, and must effectively cut off all apparatus within the building. Aerial conductor may be permanently connected at all times to earth through an improved lightning arrester placed as near as possible to the point where the wire enters the building and grounded as specified above. Ground wires for lightning arresters must not be attached to gas or steam pipes within the building, nor be run inside of iron pipes."

LUXURIOUS TRANSCONTINENTAL CARS FOR HORSES

The accompanying illustration shows one of the latest ideas in cars for the transportation of horses by rail. Cars of this type are being made in England for the Buenos Ayres Pacific railway of South America. One of the features of the car is the means provided for the loading and unloading of the animals and the provision made to protect them as much as possible from the joltings incident to a long trip. The cars are equipped with special springs and with automatic vacuum brakes. A considerable quantity of feed can be stored in the end compartment designed for that purpose, and there are comfortable accommodations for the attendants.

A QUAINT RESTAURANT SIGN

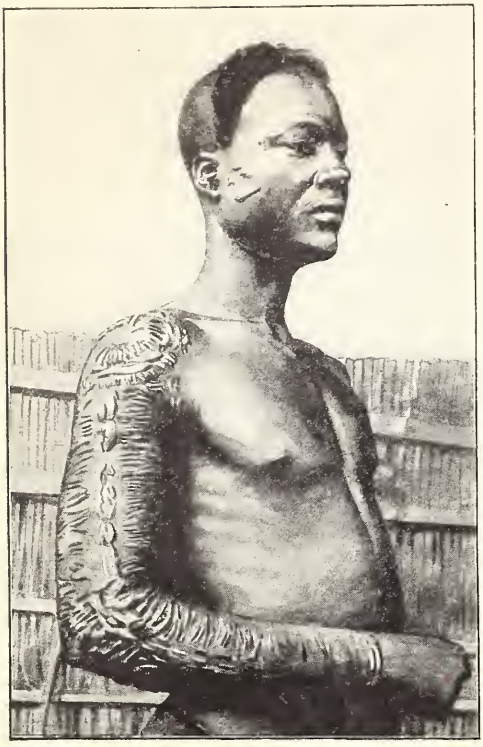
The "Copper Kettle" is the name of an artistic little lunch room in a western city, which, as it faces a private thoroughfare has sidewalk privileges not granted on a public street. The proprietor has erected a quaint sign of his business on the edge of the curb in the form of an old-fashioned kettle of real copper suspended from an artistic rack. A little roof is built over the kitchen utensil, which by its oddity catches the eye and brings many a customer.



For Transporting Horses in Comfort

TATTOOING IN BAS-RELIEF

Almost any sailorman can show a tattooed design of some kind on his skin, but the tattooing on the arm of this negro of German East Africa is a novelty. The work is not sunk into the skin, but the skin is stretched up over it in relief.



Tattooing in German East Africa

OSCAR HAMMERSTEIN AS AN INVENTOR

Oscar Hammerstein's fame has, of course, been made through his grand opera ventures, and few people are aware that his ideas run in other channels, yet the records of the U. S. patent office show that he has 36 patents to his credit.

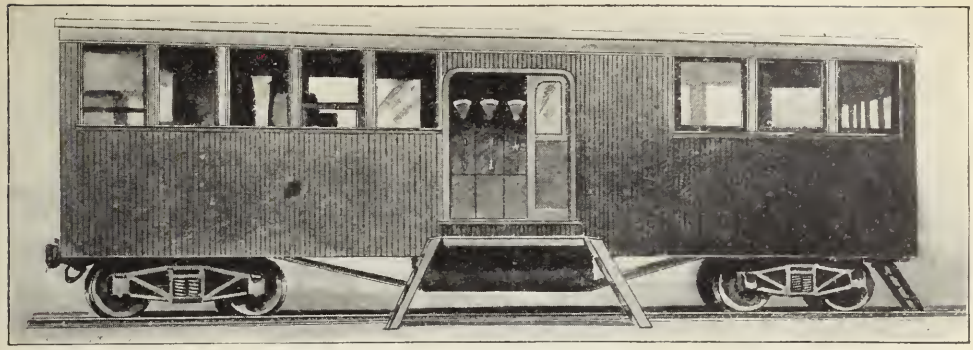
The first patent granted him was in the early seventies, and was for a washstand with which a person could wash the entire body, thus doing away with the necessity of a regulation bathroom or tub of any kind. His best inventions, however, are related to the cigar-making industry, and include compressed-air machines. From the date of his first patent on cigar machines, granted in 1880, the patent office has issued him 29 patents on machines of like nature. Some of these patents related to processes, but the majority are machines for rolling, bunching, forming, and cutting cigars or parts thereof. The last patent was issued in 1907.

In 1887 Hammerstein secured another patent on a combined washtub and basin. In 1895 he patented a fireproof floor, in 1899 a necktie provided with a washable knot and a washable apron, detachably secured to each other; and in 1903 he secured a patent on a device for smoothing silk hats. In 1906 he patented a fire extinguisher, and in 1907 a method of ventilating subways.

THE LATEST TYPE OF BASEBALL

From 1883 until last year, very little, outside of minor changes, was done in developing the baseball. The league baseball used in this period had a rubber center, and the yarn wound around it was coated with a continuous layer of rubber cement. The ball now used includes a means of preventing the inner yarn from slipping away from the

Cross-Section of Latest League Baseball



One of the Portable Sub-Stations

center of the ball, and the substitution of cork for rubber in the core. This core of cork is covered with a layer of rubber vulcanized to a certain degree of hardness, and on this is wound the usual yarn.

The cork makes possible a more rigid structure and more uniform resiliency. It is said to outlast the rubber center balls many times over, because it will not soften or break in spots under the most severe usage.

The illustration shows a cross-section of the new ball, with the cork center, rubber covering, the layer of blue woolen yarn, then white woolen yarn, then blue woolen yarn again, and the horsehide cover.

CANTILEVER STAIRWAY IN JERUSALEM

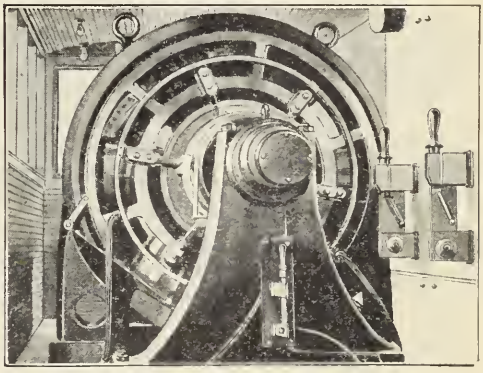
The bell tower of the German hospice (hotel) recently completed in Jerusalem is built as a cantilever. The tower is 197 ft. high and the stairway starts at the second floor. The steps are about 42 in. long, built into the wall at each end for a length of 10 in., this being the only support.

The steps are of concrete, and were made at Jaffa, on the Mediterranean sea, from shells, sand, and German cement. Each step is reinforced with a small I-beam. The under side of the steps is slanted to conform to the slope of the stairway, but the portion projecting into the wall is square, in order to secure good bearing.

PORTABLE ELECTRIC SUB-STATIONS

One of the interesting features of the power installation of the Northern Electric railway, California, is the series of portable sub-stations by which the current of 60,000 volts is transformed. These electric plants on wheels, one of which is shown in the illustrations, contain one standard 400-kw. set and a switchboard. One end of the cars is partitioned off to make tool rooms.

The portable stations must not only be located on level track, but must also be made fast in such a manner as not to be subject to vibration. This is accomplished by means of wrought iron hooks fastened to the under side



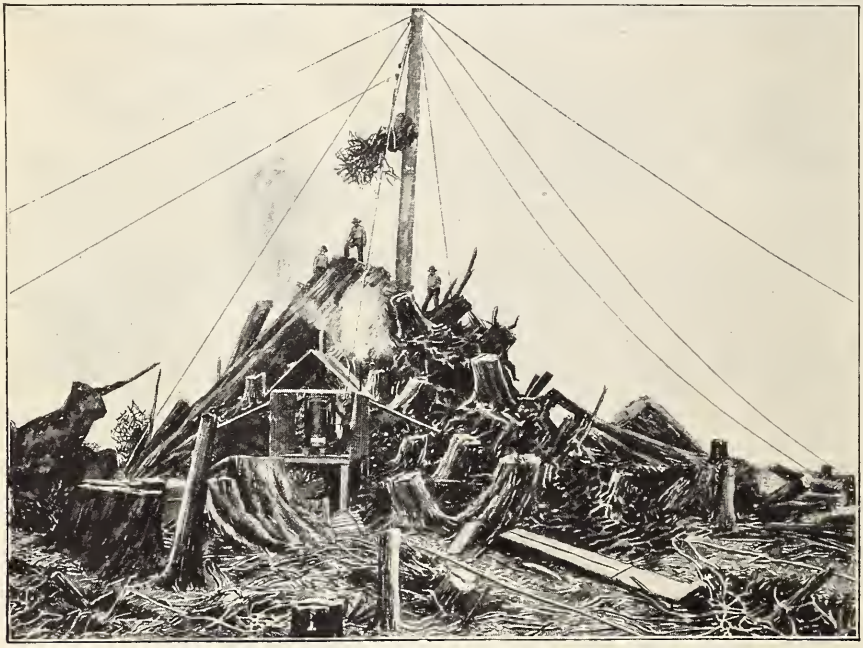
Interior of Sub-Station on Wheels

of the car-body and gripping the ball of the rails. Acting against the strain imparted by the hooks are screw jacks, which bear up against the car-body.

CLEARING LAND OF STUMPS IN NORTHWEST

This method of clearing land of stumps, used to a great extent in Washington and other states of the northwest, is both unique and economical. After the trees have been felled and the stumps blasted, a donkey engine, with upright boiler, is set up on the land for drawing the stumps into piles convenient for burning. A wire cable runs from the cable-drum through a derrick erected where it is desired to make the pile. The end of the cable is taken to the stump, perhaps a quarter of a mile away, is made fast, and the signal is given to the engineer to haul in. The stump is dragged bumping, bouncing, and sliding over the ground at considerable speed. When the stump reaches the derrick it is lifted into the air and is then dropped on top of the pile.

Piles of stumps, stacked in this way, are often as large as a huge farm building. An area of 10,000 acres was cleared in this way in Washington recently, the burning piles resembling a well-scattered town in conflagration.



Gathering Stumps for Burning with a Donkey Engine

TO TEST HARDENING OF GATUN LOCKS

Six resistance thermometers are to be embedded in the walls of the locks of Gatun dam at Panama, in order to determine the degree of heat at various stages of the hardening of the concrete, and thus find the rate of cooling.

From the time concrete begins to crystallize until it is entirely set the increase of temperature is rapid. From the setting point the increase is slow, but usually continues during the entire process of hardening, the time of which is indefinite, probably lasting for several years.

The concrete for the Gatun locks is made of one part slow setting Portland cement, three parts of sand, and six parts 3-in. rock. On account of the time that elapses between the mixing of the concrete and its delivery into the forms, the mixture is made about the consistency of thin plaster. After it is placed in some parts of the wall, large rock is added, forming a cyclopean concrete.

The thermometers to be used consist of a resistance bulb and an indicating instrument, with wire connecting the

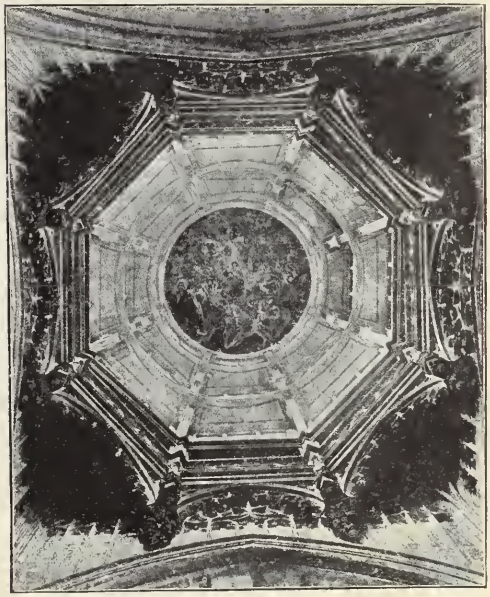
two. The resistance bulb is an iron cup in which there is inserted a specially prepared metal, the resistance of which to a flow of electric current varies with the temperature.

CAR FOR EXPEDITIOUS TRANSPORTATION OF FIRE APPARATUS

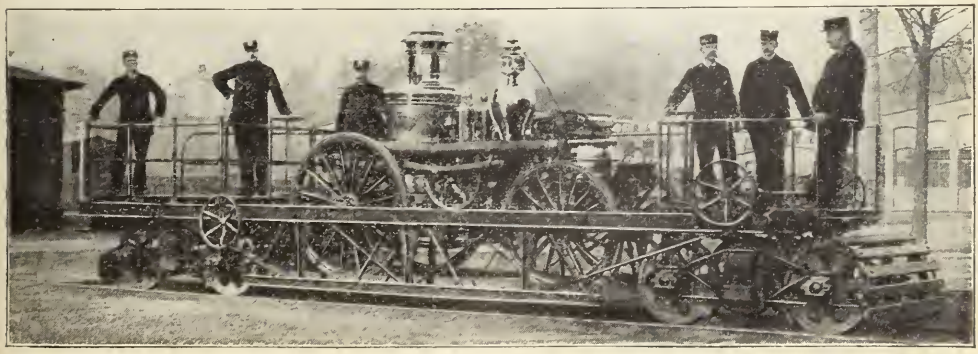
An invention that has attracted a great deal of attention in fire-fighting circles recently, is a car for the ready transportation of fire engines from point to point upon the rails either of street railways or upon the steam roads. It consists of a steel frame upon two standard four-wheeled trucks, with a low hanging platform for the accomodation of a steamer of large size. Any ordinary fire engine, such as is commonly in use in our larger cities, may be placed on board with dispatch when the call for help comes from a distance, and from a point more easily accessible by rail than by other means; and may be conveyed to its destination without loss of time in handling upon the ordinary flat car. The front truck is arranged to disconnect, letting the end of the platform down to track level. The fire apparatus is then pulled aboard by means of a winch on the rear truck, after which the front end of the platform is again raised to carrying level by chain hoist and the front truck placed in position. The whole loading operation requires about two minutes and the unloading is done in less than a minute and a half.

A UNIQUE PICTURE FRAME

This unique picture frame would draw attention because of its unusual shape were it the frame of a picture in an art exhibit, but it is not. Instead, and far more curious, it is the frame formed by the dome of the great tower of Antwerp Cathedral for the painting on its ceiling. The photograph was taken by a camera, the lens of which was pointed straight upward.



Courtesy Sketch, London
Looking Up at the Dome of Cathedral Tower



Carries Fire Engine by Rail

DEVICE FOR FILLING A PIPE

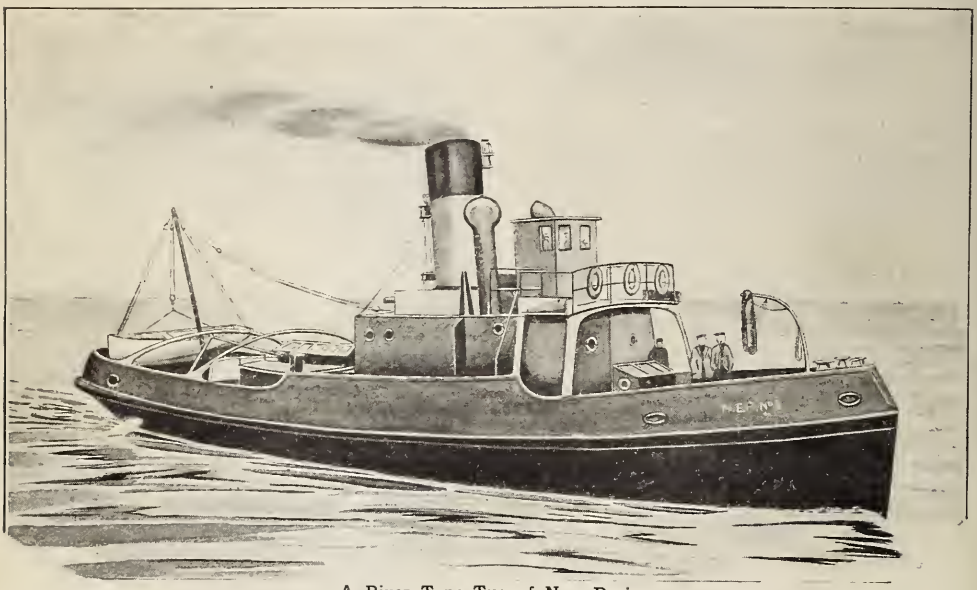
An absolutely new article has been placed on the market for smokers in the form of a pipe-filler. It is a contrivance of trifling cost that takes tobacco in specially made packets and deposits it in the bowl of a pipe, packing it to just the right degree for drawing best. The lower part of the filler is placed over the bowl, and the pressure

New Device for Smokers

of a finger on the upper part frees the tobacco from the packet and forces it into the pipe.

POWERFUL ENGLISH TWIN-SCREW TUG

This powerful twin-screw tug is one of two recently built for the use of the North-Eastern Railroad company

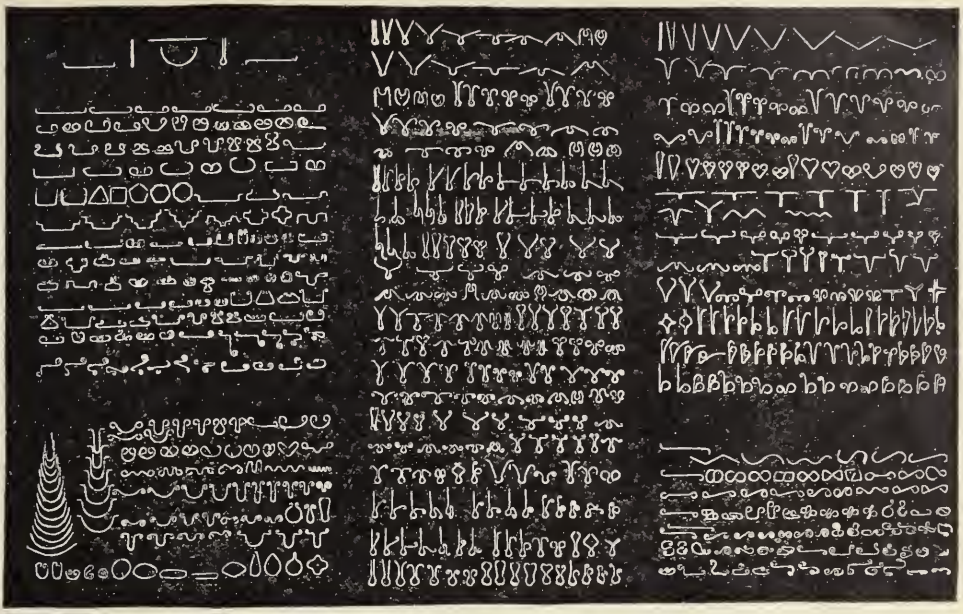


A River Tyne Tug of New Design

in connection with its docks on the River Tyne, in the north of England. It is 82 ft. long, with a 26-ft. beam and a 12½-ft. depth, and embodies many special features for the rapid and efficient handling of heavy tonnage vessels.

Owing to the large amount of traffic the space in which the vessels have to be maneuvered is very small, consequently the tugs have to be of exceptionally large power in order to get them quickly under way and to check them in the least possible distance. The two sets of compound surface-condensing engines with which the tug is fitted are capable of over 1,000 hp. for short intervals.

With a view to rapid maneuvering the keel is cut away forward and the propellers well spread, the stern at the same time being kept square to provide a maximum amount of protection. As a result, it is possible to turn through a complete circle in slightly less than a minute and in the tug's own length.



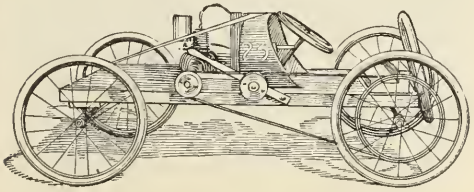
Units of One-Length Wire

SEVEN HUNDRED FORMS OF ONE-LENGTH WIRE

The 700 units of form shown in this illustration were made of wires of a given length to demonstrate the number of simple designs that can thus be formed. An English jewelry designer advocates its duplication and placing in every technical school where jewelry designing and making is carried on. The study and work of forming them covered a considerable period.

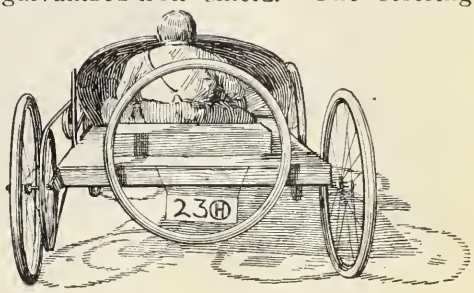
CURIOUS HOME-MADE AUTO MAKES 15 MILES

These illustrations give a side and back view of a curious little automobile made by Ralph W. Dunkle, a boy with



Side View of Home-Made Automobile

a mechanical bent, living in Greenville, Ohio. The body of this home-made car consists of a light wooden frame and floor, from the center of which rises a galvanized-iron shield. The steering



Rear View with Maker Driving

wheel is of an ordinary type. The seat is a board, and its back is formed by a circular tire. The engine is rated at 2 hp. and it gets up a speed of 15 miles an hour, through rope drive.

¶Ten huge searchlights, costing $139,000, are to be installed on the fortifications at Corregidor, at the entrance to Manila Bay.

¶An order has been placed for seventy million bricks to be used for the purpose of enlarging the fortifications at Vladivostok, Siberia.

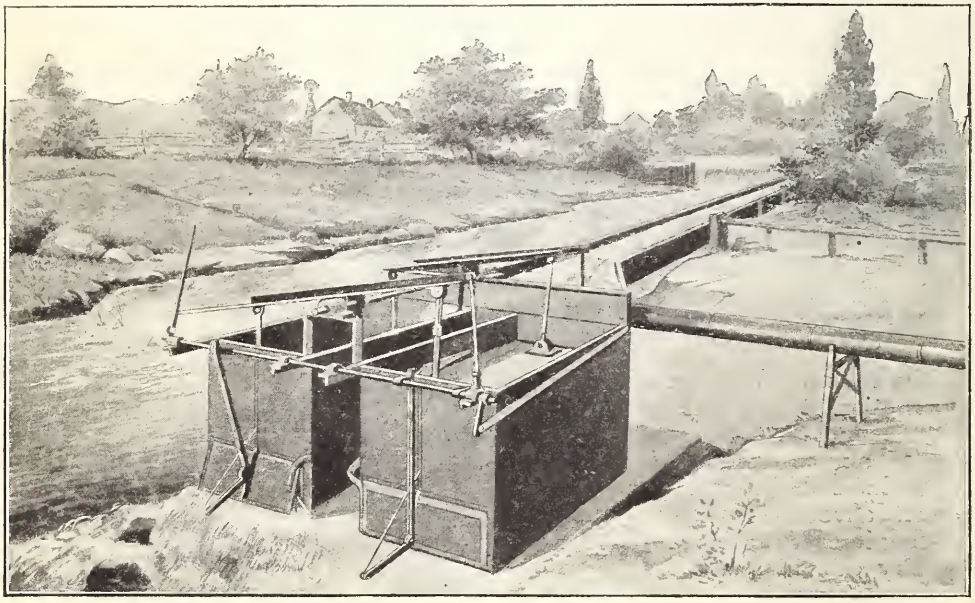
PUTTING THE SMALL STREAMS TO WORK

The great potential power of the large streams and waterways of the United States is generally recognized, and today more than ever before man is harnessing these streams to do his work.

Forming a fine network all over the country are hundreds of thousands of small streams, generally regarded as too insignificant to produce power because of the small flow of water or the absence of a fall. A motor has recently been brought out which promises to make the utilization of these small streams possible. If it stands the test, it undoubtedly has a large field, not only in the United States, but in all parts of the world.

The basic principle of this new motor is the application of buoyancy to mechanics and the harnessing of the power thus developed. A light vessel filled with air will not remain submerged in water, but will exert force to push its way to the top, displacing only its own weight of water. One of these motors is installed near Portland, Oregon, and a description of it will serve to convey an understanding of the construction and operation of the new motor better than any general description can. It is shown in the accompanying illustration.

Two metal tanks 5 ft., 6 in. deep, 5 ft., 6 in. wide, and 8 ft., 6 in. long, are placed side by side on a concrete foundation on the bank of a stream. The lower part of the front of each tank is provided with a metal outflow gate, while the upper part of the opposite end is provided with a similar gate for the inflow of water. Inside the tanks are two airtight chambers, just one inch smaller in length and width than the tanks. They are 2½ ft. deep. About 100 ft. upstream, water is diverted from the stream into a flume, built on a grade of about 2 in. to the 100 ft. In this particular case the stream is not a very small one, and all the water is not needed to operate the motor. On a very small stream the entire volume of water could be utilized in the same manner.



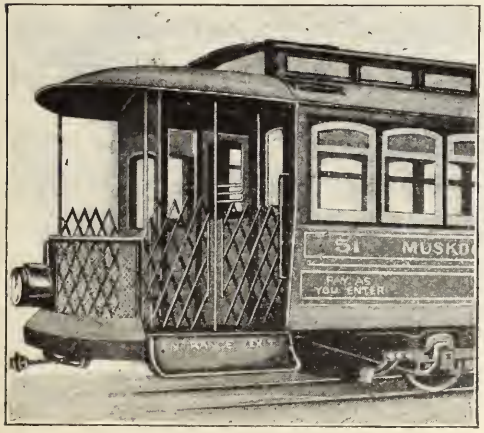
The New Water Motor in Operation

The water is permitted to enter these tanks alternately. When the inflow gate of one tank is opened the inflow gate of the other is automatically closed. Thus, as the water flows into tank No. 1 it begins to rise, forcing the air chamber up. This rise continues until the air chamber reaches its highest elevation, which occurs when the water is about 4 in. from the top of the tank. Then the outflow gate of No. 1 is automatically opened, and the inflow gate closed, at the same time the inflow gate of tank No. 2 opens, the outflow gate closes, and the operation which has just occurred in No. 1 is repeated.

Attached to the top of the air chambers are shafts connecting with a walking beam between the tanks. This is connected with two pumps which stand on the same concrete foundation as the motor, transmitting power enough to lift 36,000 gal. of water 75 ft. in one hour. This is sufficient to irrigate 100 acres of land. It is claimed that once started the motor needs no attention whatever.

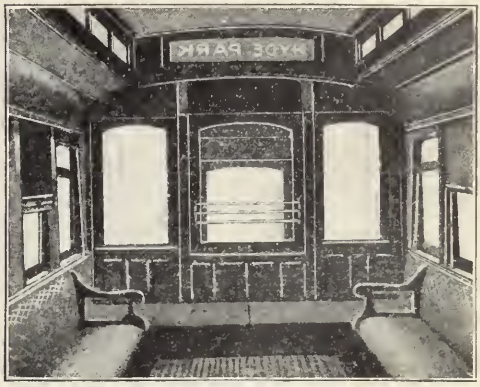
PAY-AS-YOU-ENTER CARS OPERATED BY ONE MAN

Ingenious pay-as-you-enter cars that dispense with the service of a conductor have been adopted by the traction



One-Man Pay-as-You-Enter Car

company in the rapidly growing city of Muskogee, Oklahoma. The cars have standard pay-as-you-enter non-vestibuled platforms at both ends, with folding gates on the steps on both sides, but the rear platform gates are always



Method of Closing Off Rear Platform

closed and locked and passengers must enter and leave by the front platform.

By this arrangement a conductor has become unnecessary, as the passengers are under the eyes of the motorman both in entering and leaving the car. A cab about 3 ft. square, located against the bulkheads of the car between the entrance and exit doors gives the motorman protection against the weather. Passengers boarding the car pass in front of the motorman and drop the fares in a box which hangs from the window of his cab. The car is not started until the passengers have all passed in front of the motorman, who makes change when necessary.

To prevent confusion by passengers attempting to leave the cars at the rear, folding seats are provided which extend across the doorways. This feature is shown in one of the illustrations. When the cars reach the end of the line, the motorman changes his position to the other end.

The practicability of such cars on traction lines in many communities cannot be overestimated. The dispensing with the services of conductors cuts the pay-roll for car operation in half, thus making dividends possible in small cities where traction cars might otherwise be operated at a loss.

MOTORCYCLES FOR WOMEN

Motorcycling is materially a sport for men and boys in this country, but in Europe motorcycle manufacturers

English Woman Motosacoche-ing

are building machines for women and finding a ready sale for the product. The frames of the machines are designed without the upper bar, as is the case with the ordinary women's bicycle, and the engine, gasoline tank, ignition apparatus, and oil supply are carried between the double bars of the under frames.

The fear that skirts would be likely to catch in the drive transmission and result in a serious accident may be dispelled, as the makers of the machines have so inclosed the engine and gears as to make such trouble impossible.

A motorcycle built for women is called a "motosacoche."

PRACTICING GOLF WITH CAPTIVE BALL

By means of the inexpensive apparatus shown in these illustrations the golf enthusiast is enabled to practice strokes in such restricted places as only a few feet of back yard or in a large room in a house. All the strokes except putting may be practiced with the apparatus, the clubs used including a driver, brassy, iron, mashie, and niblick.

The most important part of the apparatus is a captive ball, and the other parts include two mats and a hoop arrangement. The latter is bent or formed into five inverted hoops. To the lower part of the hoop standard is attached the cord on the end of which the golf ball is held captive. Near the center of the cord is a spiral spring, which allows of stretching, and swivelling connections are also provided to permit of the spinning action of the ball.

The cord, of course, can be length-

The Commencement of the Drive

The Finish

ened or shortened to meet the requirements of the space in which practice is to be carried on. In playing, the ball is placed on a mat as shown in the first illustration. The "driver" is first used, and the ball struck at with the same force that would be used on a regular golf links. If the ball is hit straight, the cord passes into the center loop through the narrow opening. If not quite straight, the cord slips into one of the other loops when the ball is driven over the rack. The center loop counts three points, the next on each side two points, and the outer loops only one point.

When the player has made a perfect drive, the "brassy" is taken up and used in a similar manner, and the same routine is gone through with the brassy, iron, mashie, and niblick. The ball, held captive on the end of the cord strikes the ground a few feet beyond the loops as shown in the second illustration. When the apparatus is used indoors, the mat, shown under the standard in these illustrations, is placed in such a position that the ball will strike upon it when forcibly brought down by reaching "the end of its rope."

SMALLEST DOLLS MADE IN MEXICO

The smallest dolls in the world are made in the picturesque Valley of Cuernavaca, Mexico, by a young woman who is a descendant of one of the old Indian tribes, says the Bulletin of the Bureau of American Republics. The operation of making

Matador Dolls—Actual Size

consists in forming a diminutive framework of wire, barely ¾ in. in length, and winding it with many turns of fine silk thread. After the frame has been fashioned to the proper lines and proportions, it is ready for dressing. The clothes are cut according to the character of the doll, and fitted carefully about the small figure.

Tiny Dolls Representing Natives

The most difficult work, that of embroidering the clothes, is then begun. With a needle that can scarcely be held by the fingers, and whose eye is almost invisible, various designs are actually embroidered on the clothes with the finest of silk threads, and so cleverly executed that even through a powerful magnifying glass the details appear to be perfect, although the entire work is done without the aid of an enlarging device of any kind. After the dressing has been completed it is necessary to add the hair. What is undoubtedly an example of the tiniest and most remarkable hair dressing on earth is then performed on each doll. Even to the details of the braids and ribbons, the work is completely carried out. The eyes, nose, mouth, hands and feet are then formed.

Only two hours are required to make each doll. Many characters, familiar to the country are represented by the dolls, dancing girls, matadors, religious dignitaries, and native types. Photographs do not do justice to the splendid coloring and wonderful execution. The sketches show the actual size of the dolls.

¶A fund of $9,000,000 is being raised by public subscription in Brazil for the building of another great Dreadnought.

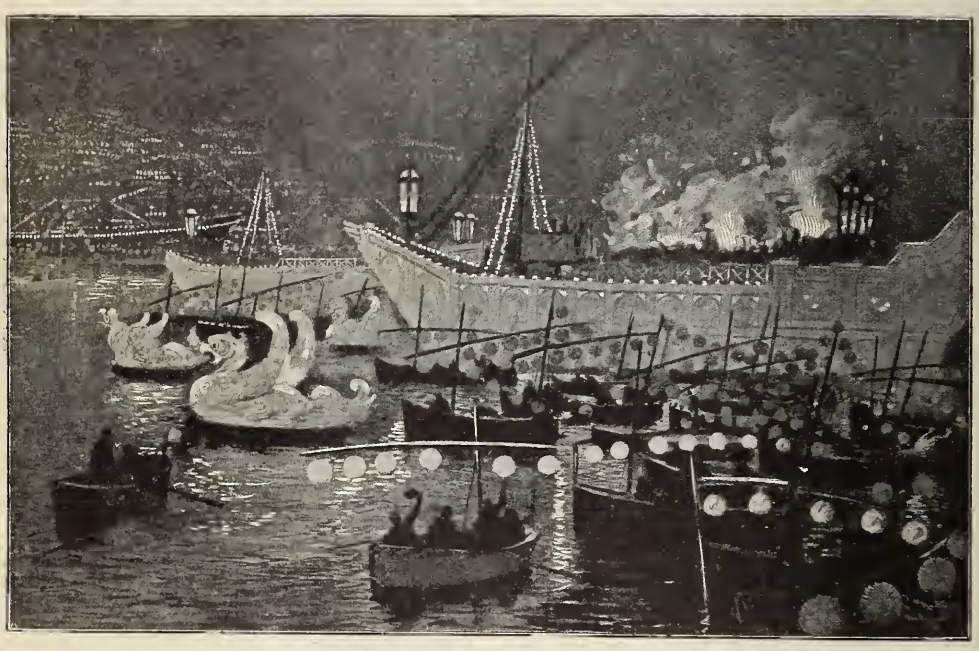
¶Telephones are now being used for the transmission of train orders on 295 roads in the United States, covering 26,344 miles of road so operated.

A NIGHT FETE AT MONACO

One of the most brilliant episodes accompanying the opening of the oceanographic museum at Monaco was a beautiful water pageant, the theme of which was the arrival of Hercules Monechos in the roadstead.

The whole stretch of water and the steep hills of the principality of Monaco were brightly illuminated, as were the floats in the pageant. The central float was a huge galley, which carried the famous singer, Ruffo, who impersonated Hercules Monechos. Another galley of the same size, and several smaller floats, formed in the shape of dragons and swans, made up the procession. Hercules Monechos chanted a salute to the earth, a chorus making echo.

The magnificent museum is to be devoted to marine zoological research. It was erected by the Prince of Monaco, and its inauguration was attended by representatives from the different European governments and the principal scientific societies.



Night Water Scene at Monaco

IRRIGATION IN MEXICO

The Mexican government is now planning to utilize the waters of the Nazas river by the erection of a dam and irrigation work which will cost in the neighborhood of $6,000,000. The Nazas river rises in the northwestern corner of the State of Durango, flows south and east 225 miles, and is finally lost in the Laguna district, near Torreon. About 35 miles to the south of the source of the Nazas, and in the same range of mountains, the Sierra Madre, the Tepehuanes river takes its start, and flows in the same general direction for 60 miles. It is then joined by the San Tixco, while a fourth river, the Rio de la Palmas, is formed by the junction of the Tepehuanes and the San Tixco, and flows to the northeast for 50 miles, emptying into the Nazas. The territory drained by this system of rivers, with its numerous small streams, is over 20,000 square miles.

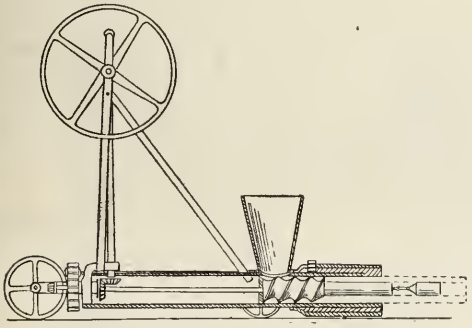
At certain seasons of the year all these rivers are without water, but during the rainy season the upper parts

of the Nazas have an abundance of water for irrigation purposes, and it is to save this water for use in the dry season that the dam is to be constructed. It will probably be located in the San Fernandez canon, 40 miles above Torreon.

JOINTLESS CEMENT PIPE

A machine that makes continuous, jointless cement pipe is shown in the accompanying drawing. The cement is poured into the hopper, and from this is forced backward by a revolving screw, which drives it around the core. The core, which is connected with the screw, rotates with it, and the cement pipe is deposited in the ditch as fast as it is formed, the machine moving forward as rapidly as the pipe is made. Trailing behind the main core is a funnel-shaped attachment which gives the pipe an inside finish.

The power for turning the screw and for propelling the machine forward is gained by turning the large wheel. It

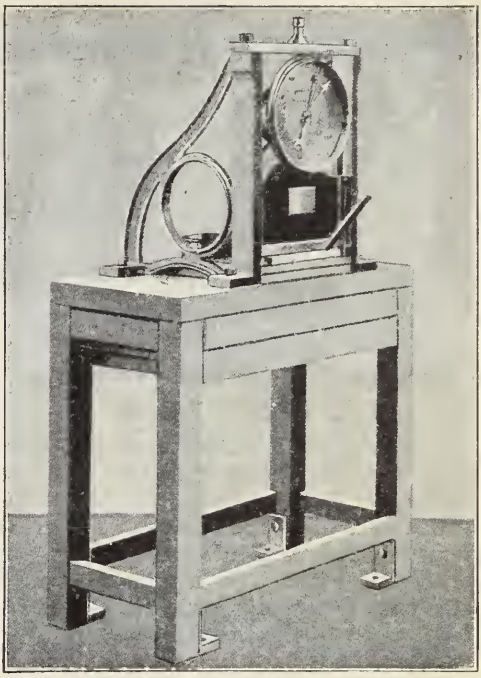


Continuous Cement Pipe-Making Machine

is claimed that 800 ft. of small pipe can be made and laid in a day.

MEASURING FORCE OF BLOWS STRUCK BY BURGLARS

M. Bertillon, the famous inventor of ways and means for making the criminal's life precarious, has added a new device to his collection in this curious apparatus for recording the amount of force represented by marks left by burglars' tools on wood.



New Evidence Gatherer in Crime

The apparatus consists of two dynamometers, which, placed at right angles, are used to register pressure and horizontal traction. A piece of wood on which a burglar's tool has left its mark is brought to the machine for measuring and a similar piece of wood is provided for the test. The test piece of wood is placed in the machine and the marks on the original piece of wood are reproduced upon it by means of a tool like that used by the thief, the amount of force required to make the marks being registered by the apparatus.

M. Bertillon claims there are occasions when it may be highly advisable to know the exact amount of force used by a burglar.

¶A million bales of cotton are used every year in the manufacture of automobiles.

¶France leads the world as an exporter of automobiles, with the United States second in rank.

Different Conceptions of the Arms of Venus de Milo

THE PROBLEM OF THE ARMLESS VENUS DE MILO

Ever since the famous armless statue known as the Venus de Milo was found on the island of Milos in 1820, the world of art has tried to solve the mystery of the original position of the arms. The statue represents a woman standing with the weight on the right foot, and with the head turned slightly to the left. Both arms were broken off near the shoulders, leaving just enough to indicate the general direction in which they were extended.

At a recent meeting of well known artists and sculptors in London, several copies of the famous statue, with arms provided, depicting the ideas of the artists as to the position of the arms, were shown. Six of these are here illustrated, the second and third being the most popular of the conceptions.

NINETY TONS OF SALMON

This illustration shows part of a pile of red salmon that, although weighing 90 tons, was cleaned, canned, and cooked within a few hours after the photograph was taken. The huge pile of fish was brought in at Kogging, Alaska, one of the many fishing stations of the Bristol bay district.

Where Fishing Is Good

The fish are cleaned and placed in the cans by machinery, and cooked in steam at 220 deg. F. for 45 minutes. A small hole is then punched in each can to allow the gases to escape, the

holes are soldered up, and the contents are cooked for an hour more in steam at 240 deg. F. After the cans have cooled they are given a coat of lacquer to prevent rust, then receive the labels, and are ready for shipment.

AN ATTRACTIVE RESTING PLACE

When real estate agents wish to "boom" some new tract which has the disadvantage of being far from the center of town, they usually spend a good deal of money in beautifying it. The idea is that people will be glad to ride 15 minutes longer on the cars if their destination is some palm-bordered place with paving and street work in perfect shape.

In addition to this, a certain Los Angeles firm has conceived the idea of placing highly ornamental structures at each corner in the tract. They are made of concrete and rough timbers, while the roofing is of tiles reminiscent of the California missions. The effect of the little barred niches is that of a wayside shrine such as are found in the Old World, but the practical feature of it is that it affords a comfortable resting place while waiting for the street car and this is quite appropriate as a suburbanite spends much of his time on the corner waiting for the cars.

SPANISH RECRUITS KISSING MILITARY CROSS

When Spanish recruits join the army they have to file before the colors of

Standard and Sword Form Cross

their regiment and kiss the sword held against the standard. The upright standard with the sword held against it forms a cross. The illustration shows recruits being sworn into the army in Madrid.

Resting Spot a Suburban Attraction

PROPOSED MOTOR-SLEIGH FOR EXTERMINATING WOLVES

A correspondent of the Graphic, London, suggests the use of automobile sleighs with bodies enclosed with strong wire cages, for hunting wolves in eastern Europe, especially in Russia. The animals abound there and exact annually a terrible loss of human life, besides killing domestic animals in great numbers. It is pointed out that hunters with this equipment can make dashes into the wolf infested country and shoot hundreds of them without danger.

Fighting the Wolves

Some figures from Russia will give an idea as to the extent of the ravages of the wolf. In one year alone, within a single district of 20,000 square miles, wolves destroyed 1,800 horses, nearly 16,000 sheep, over 17,000 oxen, and large numbers of other animals. In addition to this, 161 human beings were killed and eaten. In Hungary wolves are the scourge of winter, filling the whole countryside with terror and apprehension. There the tireless hordes of wolves wage a constant war against man and all his belongings.

IMMENSE OIL RESERVOIR BURNS

A large concrete reservoir owned by the Standard Oil Co. near San Pablo, Cal., and containing about 300,000 bbl. of oil, caught fire recently, and after burning 17 hours, in which time only 18 in. depth of oil had been consumed, exploded. The burning oil poured over the sides of the reservoir and spread over the surrounding country. Trenches, which had been hastily dug for just such a contingency, proved entirely inadequate. The oil spread along the tracks of the Atchison, Topeka & Santa Fe tracks for a distance of five miles.

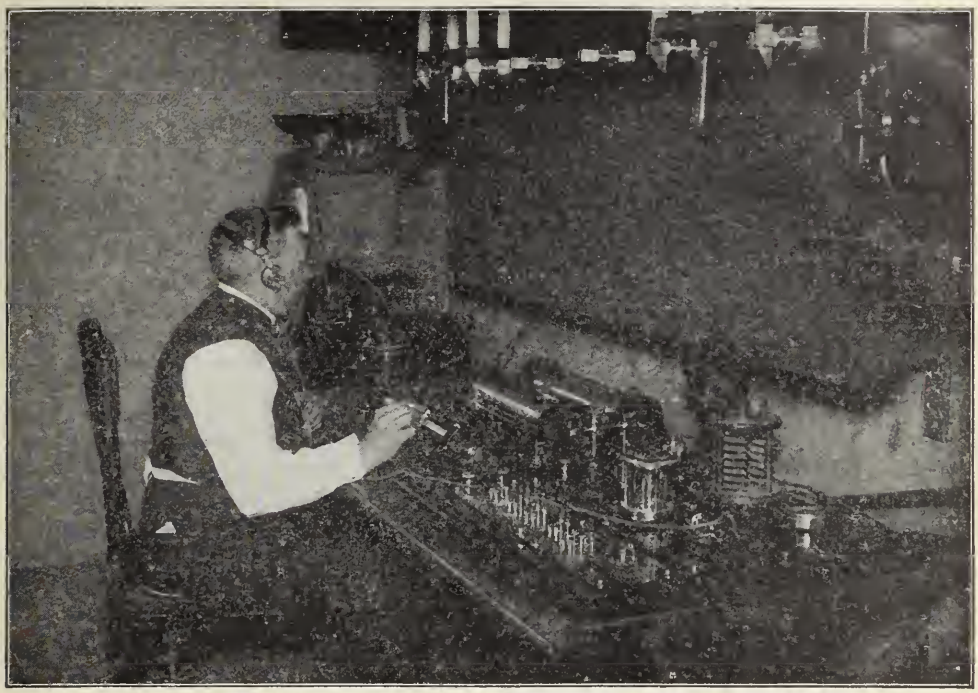
Practically all of the oil in the reservoir was blown out by the explosion, which was caused, it is believed, by the boiling water collected in its bottom.

AUTO AS FRUIT-VENDING VEHICLE

A fruit vender in Berlin owes his success to the fact that he peddles his wares from an automobile. The idea of an itinerant vender of fruit owning an automobile was a sufficient novelty to draw for him three or four times as much trade as would have been forthcoming were his vehicle an ordinary pushcart.

Auto Fruit-Vending Machine

¶An American firm is trying to secure a concession to build a system of elevated railway in Pekin.



Dr. Frederick H. Millener Tuning Wireless Telephone Instruments in His Workshops at Omaha, Neb.

A Pioneer in the Wireless Operation of Railroads

By HARRY F. KOHR

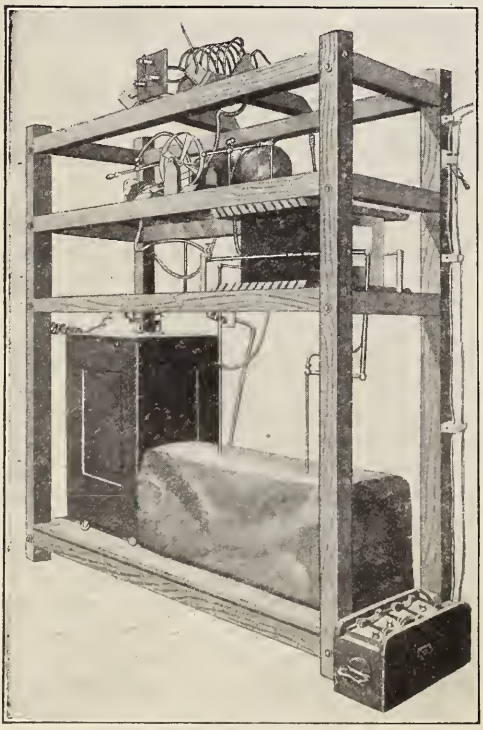
NEXT to its employment at sea the wireless system of communication may find its widest field of usefulness on our great railroad lines. Three years ago a series of experiments was begun in the Union Pacific shops at Omaha, and Dr. Frederick H. Millener, who has been in charge of the work, now states that a wireless system for communication between stations has been perfected. Success has likewise crowned efforts to communicate between stations and running trains.

The Pennsylvania railroad has also been attempting to apply the wireless to railroad work, and has an experimental plant at Altoona, Pa. The mast in use for the tests is erected on a mountain, at a point 1,655 ft. above sea level, the receiving apparatus itself being 1,735 ft. above the level of the ocean. Communication already has been established with various wireless stations along the Atlantic Coast, as well as with various vessels at sea.

Work is already under way on a main plant at the Union Pacific headquarters in Omaha and two branch plants, one at Sidney, Neb., and one at Cheyenne, Wyo.

These stations are approximately 200 miles apart, too widely separated to be of much service except when the wires go down. To any one at all familiar with the operation of a railroad it is obvious, that it would be quite impossible to carry on the enormous traffic of a great transcontinental system with telegraph stations 200 miles apart. But these stations are only the foundation of a still greater and more intimate utilization of the

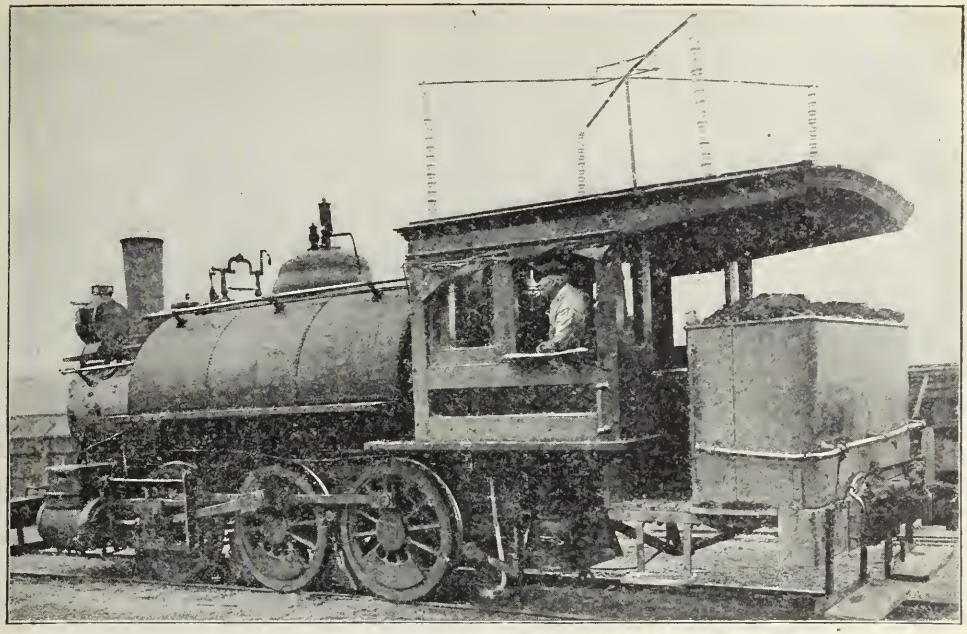
Boiler Shops of Union Pacific at Omaha Showing Aerials for Transmitting Orders to Trains by Wireless



First Wireless Set Made and Used for Experimental Purposes at the Union Pacific Shops

wireless system—communication direct between the dispatcher and the engineer.

While Dr. Millener was working out his system of wireless telegraphy, he also was applying the same efforts toward solving the problem of a wireless telephone by which it would be possible to communicate with running trains. The wireless telegraph was the foundation of Dr. Millener's scheme and he perfected that first. The wireless telephone is the superstructure. When the wireless telegraph stations are in operation the telephones will be ready to install, and thus there will be a double safeguard. But Dr. Millener wasn't quite satisfied with even a double safeguard, so he added an insurance policy, as it were, in the shape of an electric cab signal to work in connection with block signal system already in use. The cab signal also works by wireless electricity, showing the movements of the signals at each end of the block upon which the train is running. The cab signal was an incidental discovery while Dr. Millener



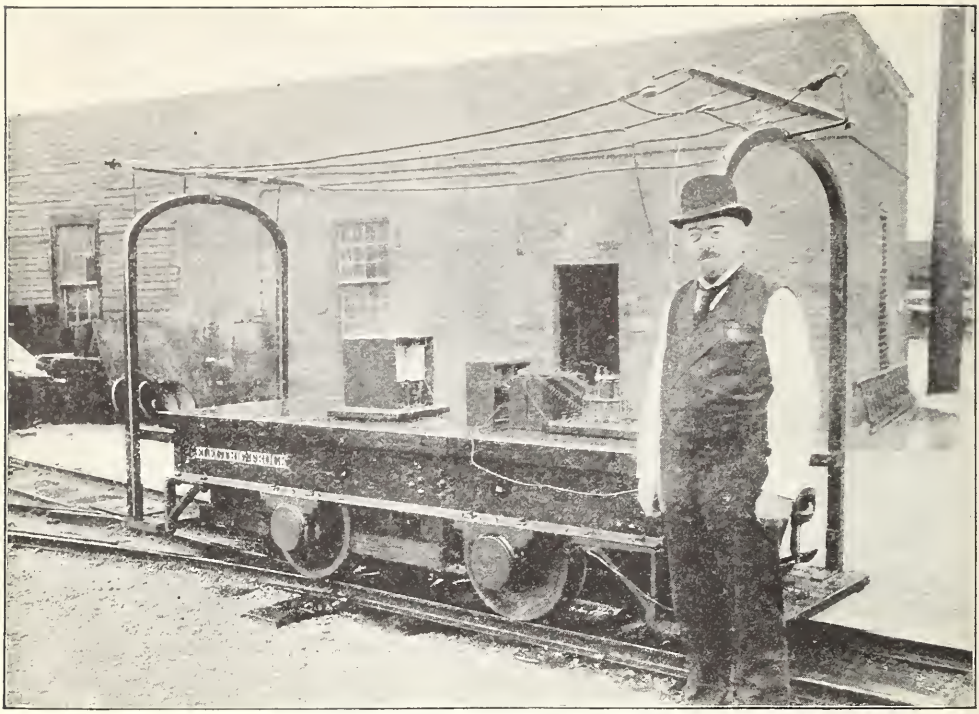
Engine Fitted for Receiving Wireless Orders—Receiving Instruments Are Located in the Cab

was working on his telegraph and telephone apparatus, and just for the present it is lying aside for future development.

As it will be worked in practical operation, the chief dispatcher at headquarters will issue his orders and send them by wireless telegraph to the division dispatcher. The division dispatcher makes up his charts and from his office telephones his orders to the engineer and the conductor. No chance there to run by a station where important orders wait, no chance for the operator to sleep while the night express thunders by to meet the limited between stations at 50 miles an hour and fill the news columns next day with the list of dead and injured. The dispatcher has every train right under his thumb and when the engineer disregards orders he is rounded up with a jerk. He can not plead misreading of orders. There is only for him the confession of gross criminal carelessness when something happens that shouldn't.

Dr. Frederick H. Millener, Whose Experiments with Wireless Are Attracting World-Wide Attention

In conducting his various experi-



A Truck That Is Operated by Wireless

ments, Dr. Millener has achieved some remarkable results. In his work he uses one of the largest transformers built for wireless use, 40 per cent greater in capacity than the Marconi machine at Glace Bay, Newfoundland. "Feeling" through space he has often caught messages from ships at sea, frequently he has talked with Brant's Rock, Mass., and on occasion has conversed with West Indian stations, with the station at Havana, and even with ships in the harbor of that city.

In the various experiments with telegraph, telephone and cab signals, Dr. Millener used an old switch engine, equipped with antennae suspended from insulated posts on the roof of the cab. While he sat in his laboratory in the boiler shop, one of his assistants rode on the engine and conversed with him either by telegraph or telephone. Finding that antennae were liable to damage on a running engine or train, Dr. Millener did away with them entirely, and his later experiments were conducted simply by insulating the metal roof of the cab and running wires from that to each of the devices. The "ground" is made through the wheels.

Beyond the bare facts, little information is given out about his discoveries, either by Dr. Millener or the Union Pacific. One reason is because these devices have a high patentable value. A second reason is that all of the devices are so intimately related with others that Dr. Millener has in mind that to tell the secrets of one might give a clue to others. In a general way it may be said that Dr. Millener's telegraph apparatus works upon the same general principle as the Marconi and De Forest systems, better described perhaps by saying that it combines the best points of both with a few good ones that he has brought out himself. The wireless telephone at first glance looks like the commoner styles of an Edison phonograph.

His experiments have attracted wide attention and hundreds of inquiries

about them come to him every week. Many inquirers make personal visits. But so closely does Dr. Millener guard his secrets, that he alone assembles his various machines. He leaves the details to his assistants. Seldom, if ever, are two parts of a machine made in the same shop, seldom does one workman handle two parts of the same machine at the same time. Most of his supplies come from abroad, some from Germany, some from France. Some he makes himself. Nobody knows as much about anything of the devices he makes as he does himself.

Just at present, Dr. Millener would rather talk about his wireless truck. Everything is wireless with him. In odd moments between his thinking spells he built a truck to run around the Omaha yards with power that he sent through the air from the boiler shop. He gave the first exhibition of it before the members of the Japanese industrial commission when they visited Omaha, and it was quite a success. Later on it may be put to practical use. Dr. Millener has his eye on a lot of dinky switch engines which he believes will look well on the scrap heap after his wireless truck begins to "kick" freight cars around the yards. Also, he believes, a lot of perfectly good copper is being used for trolley wires to run cars that might just as well be run by wireless. That will come later, too, so Dr. Millener affirms.

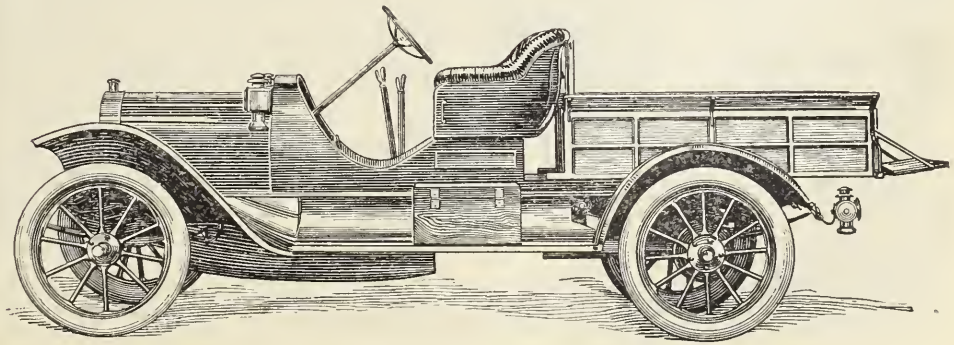
And then there are those miles and miles of electric light wires that clutter up our city streets, or go out of commission every time the conduits get full of water. They're useless, says Dr. Millener. Why not use wireless there, too. It's easy. See! And he turns a switch that lights Omaha's big auditorium with electricity that comes through the air from the army station at Fort Omaha, five miles away.

These are small things compared to Dr. Millener's wireless telegraph and telephone and his electric cab signal in practical railroad operation. With them in use only the tearing up of the track or its burial beneath feet of snow or some such unpreventable catastrophe can interrupt the operation of trains.

DETACHABLE EXPRESS BODY IN PLACE OF TONNEAU

A new and practical innovation in the automobile line is this express body, used in the place of the tonneau, with which it can be replaced in a few minutes when desired.

Such an arrangement fills a long-felt want on country estates to take care of the odd jobs of moving and delivering. It is used in moving goods from the city house to the country house, taking trunks to and from the station, etc.



Express Body Replacing Tonneau

Test of Tractive Power of Modern Automobile

THE PULLING POWER OF AN AUTOMOBILE

Proof of the pudding is always in the eating—and of the automobile in the "stunts" it will do. Much has been said about the lack of tractive power in the modern automobile, but demonstration seems to be furnished, in the accompanying photograph, of the ability of one small car, at least, to make itself useful in this department. A light machine recently pulled a "dead" street car the full length of a Detroit thoroughfare, with extra load beyond its seating capacity. In the same city another car has been used to shunt freight-cars about on yard tracks. It is probable that no great demand will ever exist for this sort of service from motor cars but, in emergencies, they are quite as useful as horses and far more readily handled.—Contributed by Barry Newcombe, 6109 Monroe Avenue, Chicago, Ill.

COSTLY TORPEDOES LOST DURING PRACTICE

The establishment of a proposed torpedo practice range at Bournemouth, England, was opposed recently by steamship companies and hotel proprietors, who claimed that the practice might ruin the season at the nearby resorts. It was made plain, however, that the torpedoes used in practice have merely dummy heads, not ones filled with explosives. The loss of torpedoes is a subject which has caused the admiralty much concern. Within a short time 10 of them were lost from

Marine Monster Cast Up at Southsea, England

English battleships, cruisers, and torpedo-boats, the value of which exceeded $25,000. The illustration shows one of these torpedoes, which went astray during practice, cast up on the shore at Southsea.

AEROPLANES PROVIDED WITH GUNS

Experiments are now being made in France with aeroplanes as offensive weapons, guns being mounted on the machines. Latham is fitting a rapid-fire gun on one of his Antoinette machines, and believes that as he operates his machine mostly with his feet, he will be able to aim and fire the gun himself.

In one of the experiments on the field at Chalais Meudon an aviator flew to a height of more than 1,000 ft. with a gun mounted on the frame of his machine. A new type of aeroplane carrying two machine guns is also being tested out.

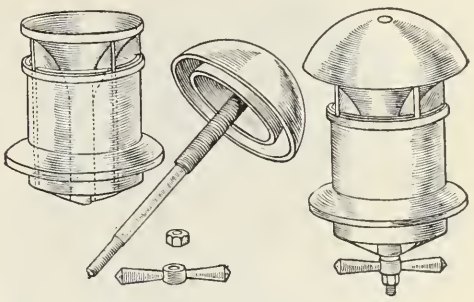
RIDING VEHICLE FOR COTTON PICKERS

One of the latest patents in cotton harvesting machines is not, in reality, any more of a harvesting machine than is a hayrack. It is, in fact, a low, three-wheeled vehicle on which a cotton picker may ride while performing his task. It consists of a frame made entirely of steel and iron, provided with a seat for the picker and a platform on which the gathering bag rests. The person picking cotton rides upon the vehicle as it is drawn between the rows of cotton by a horse or mule, and deposits the cotton he picks by hand into the bag. A brake, operated by the feet, brings the vehicle to a stop opposite the cotton stalks.

Among the advantages claimed for the vehicle is that it makes cotton picking easy and saves the back, which results in quicker picking.

NEW VENTILATOR FOR SMALL BOATS

A new type of ventilator for small boats has been placed on the market. It consists, as may be seen from the illustrations, of a cylindrical body with a mushroom shaped top. The inside of the body is provided with four guide blades. The ventilator acts as a combined intake and extractor. The air is taken in at whatever side happens to be facing the wind and passes down past the guide blades to the cabin below. There is a suction on the side of the ventilator away from the wind and through this air from the cabin is drawn out. The dome top has a thread cut on its spindle and in case of bad weather can be screwed down over the ventilator, making a watertight joint and preventing possibility of leakage.



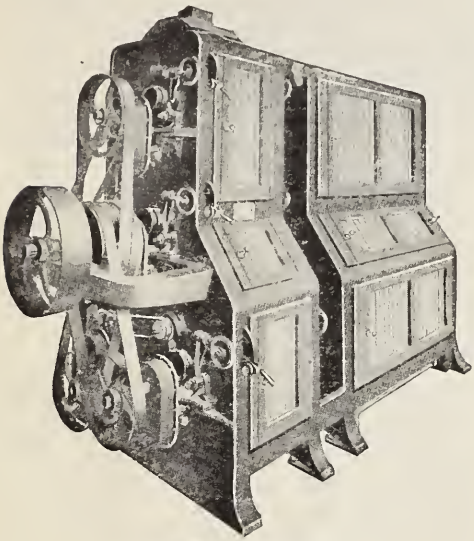
Detail of Ventilator

A Cotton Picker's Vehicle

¶A short branch of the Great Western railroad of England has been provided with a regular passenger service of rail automobiles.

SMALL, COMPLETE FLOUR MILL

A self-contained flour mill occupying a floor space of only 8 by 4 ft. with a height of 6 ft. and a total weight of



Roller End of Flour Mill

5,800 lb., capable of turning out from 25 to 50 bbl. of flour per day, is a recent innovation in flour-making machinery. It is said that the flour made by the machine compares favorably with the best product of large mills.

The scalping, grading and dressing is done by four silk-covered centrifugal reels, ingeniously divided and arranged so as to take care of the ground stock. Each of these dressers is provided with a brush which keeps the silks clean. The entire plant, including the engine, wheat cleaners and mill, can be easily operated by one man.

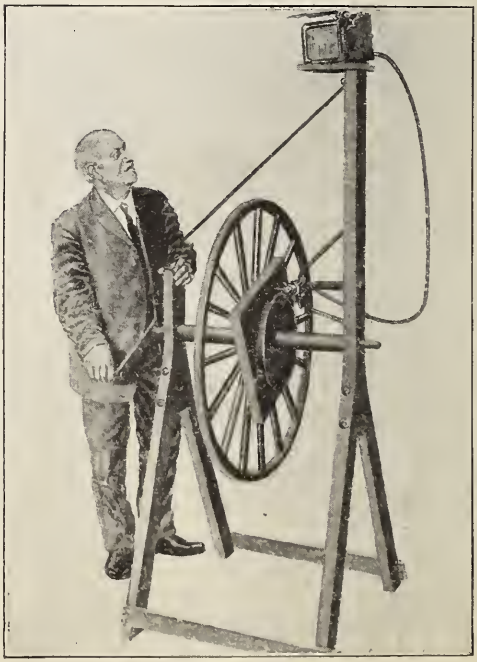
DISTINCTIVE TYPES OF UNITED STATES NAVY MOTORBOATS

The recognized marine term for boats driven by gasoline engines is "motorboat," but this name is too general for unqualified use in the U. S. navy. Consequently, the different types of such craft will bear the following distinctive names: The barge of a flag officer will be known as a "motor barge," service type launches built for heavy duty, and speed and semi-speed boats will be known as "motor boats," sailing launches with auxiliary power engines as "motor sailing launches," double-ended power boats, whaleboat type, as "motor whaleboats," power dingies as "motor dingies," and power dories as "motor dories."

DEVICE TESTS TAXIMETERS

The sealer of weights and measures in Washington, D. C., Col. W. C. Haskell, has devised an apparatus by which he tests the accuracy of taximeters. By attaching the flexible wire of a taximeter to the large wheel he can find out in 100 turns whether or not the taximeter is cheating the taxicab company or the passenger.

One hundred turns of the wheel represent a quarter-mile ride in a taxicab, and every taxicab in the District of Columbia must carry a taximeter tested by this machine.



Washington's Taximeter Testing Device

THE MAKING OF ARTS-CRAFTS LAMPS

By JOHN D. ADAMS

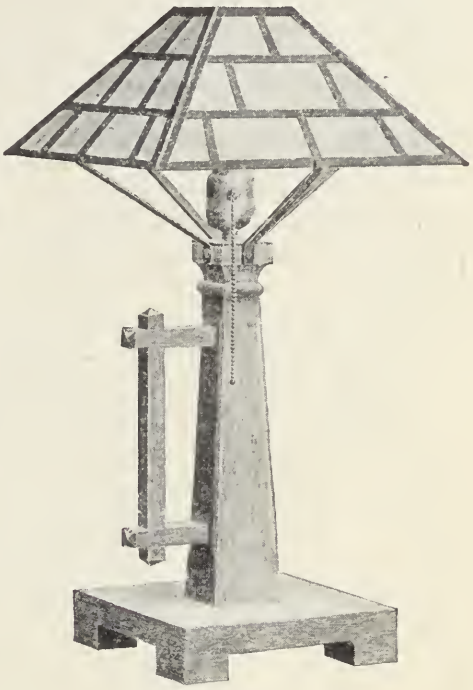
PART I

This is the first of a series of articles on lamps designed to be used in combination with mission furnishings and arts-crafts articles. These are the things most desired in furnishing homes of the present day, and a handy workman with some knowledge of tools can make and finish such pieces or articles necessary to harmonize with the surroundings.—THE EDITOR.

THAT really artistic lamps—portable ones for reading, pendant lamps for the porch, domes for the dining room, lanterns for the den, in fact all manner of lamps that are usually made from expensive leaded glass—can be made from paper, cardboard, and wood, may seem a trifle strange; but still stranger will it seem when it is stated that these results may be accomplished by almost anyone who has ever used a saw, plane, and pocket knife, and is still in possession of a fair amount of patience. But, you will say, it is quite impossible that from cardboard and colored paper a shade can be produced that will be as beautiful as one of leaded art glass.

Of course, there is a difference, but it is very much less than would be imagined, and is hardly noticeable when the shade is illuminated. During the day time the colored paper is quite attractive, whereas the colored glass is very dull and often decidedly unattractive when not illuminated. But once more, you will object that the cardboard shade must be very frail. True enough, they will not stand as much crushing as a metal frame, but then shades usually break by falling, and falling can not harm our cardboard-paper shade, so that under ordinary conditions the latter is safer. However, be this as it may, cardboard formed into angles, properly braced and connected, becomes very rigid. Like a roof truss, its strength lies more in its shape than in the amount of material employed.

To restate our original proposition:

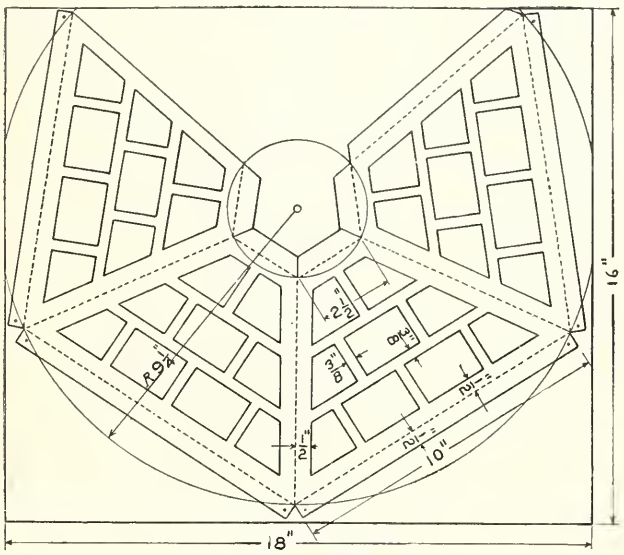


One-Light Portable Lamp

Anyone with sufficient patience to avoid all hurry can, at home, at an almost negligible expenditure, produce a great variety of lamps, that will, nine times out of ten, be mistaken for the product of a professional rather than of an amateur. In this line of work the results are invariably delightfully surprising.

Handicraft work is becoming more popular every day, and outfits for metal etching, perforated brass work, hammered copper, and various other crafts, are now supplied by the large department stores. But none of these hobbies find such a wide or important application in the home as the subject of lamps; and after the reader has become familiar with the general system of construction, and has gained the confidence that comes with some little actual experience, the work will be found

intensely interesting. The effect on the eyes of a properly shaded lamp, the artistic effect in the combinations of various colors, the opportunities presented for individual ingenuity in adapting the color scheme to that of the room, will all be duly appreciated as the work proceeds. The largeness of the field will also prove attractive to the amateur craftsman. A hanging lantern for the porch, a chandelier for the living room, a dome for the dining room, a pair of bracket lamps for the den, a portable for the library table, and shades for a drop light here and there about the house, will all be required.



Layout for Shade

Through all this work the general method is largely the same, so that after a few lamps have been made, the enterprising amateur will find ample opportunity to exercise his or her ingenuity in the way of adopting and combining such attractive features observed in other lamps that have struck the fancy, and finally will have the satisfaction of designing and constructing a lamp entirely from original ideas.

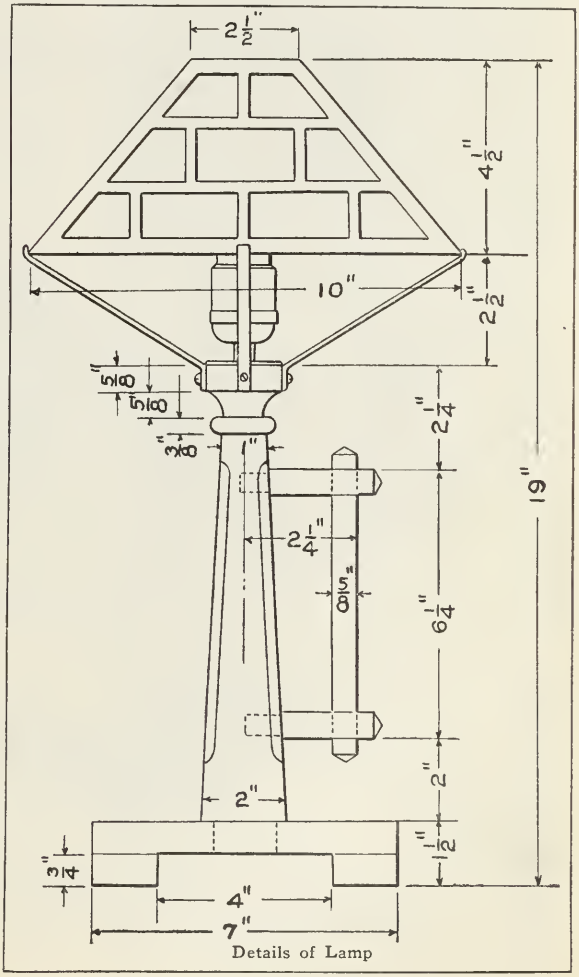
About all the tools necessary are those required for the little carpentry work in connection with the stands. A good sharp pocket knife with a large handle should be provided, and its point must always be kept particularly sharp, else the edges of the cardboard will be irregular and frayed. A roll of black passe-partout tape, some drop-black paint, a bottle of liquid glue, a box of brass paper fasteners, are all the necessary supplies required besides the cardboard and colored papers.

A One-Light Portable Lamp

Let us first consider a one light portable lamp—a lamp suitable for a desk or small table. The first thing to do is to lay out the pattern for one of the sides of the shade, which should be done on a flat and rather heavy sheet of paper, after which it should be carefully cut out with a sharp knife. A sheet of cardboard, 16 by 18 in. should now be procured. The reader should be cautioned against trying to work with too heavy a grade of cardboard. Select a moderate weight and test it by lightly scoring one side with a knife and bending it to a right angle, the knife mark always being on the outside of the bend. If the cardboard is cheap and short-fibered, the fact will be evident when so tested. Place the paper pattern on the cardboard and mark it off with a sharp pencil. Then move the pattern over one space, that is, move it until one edge exactly coincides with the outer pencil line of the first position, and mark off again, continuing the operation until the fourth and last side has been marked off. In this manner we obtain the complete pattern on our sheet of cardboard as shown. The dotted lines indicate those that are to be scored with the knife for bending, and the full lines those that are to be cut clear through. It is advisable that the cutting be done over a hardwood board, and in making the first pass with the knife do not press

too hard, as the hand or straight edge is more apt to slip at this stage than when the cut has reached some depth. Any rough or torn edges should be smeared with glue and sandpapered when dry. When all the cutting has been done, place the line of bend directly over the sharp edge of a table or board and the straight edge over that portion remaining on the table, then bend gradually all the way along. The last edge of the fourth section has a connecting strip which should be covered with glue and then fastened to the first edge of the first section. The extra strips at the top and bottom should finally be bent inward to a horizontal position and fastened with a paper fastener at each corner. The corners of all bends should be reinforced with passe-partout tape. The entire framework is now to be painted a dull black, which, in anything but broad daylight, will be invariably mistaken for the usual iron work. Select some paper of the desired shade and color, and before attaching it, try the effect after dark by bending it around a light. Sometimes two or even more thicknesses may be necessary. Generally, in a tapering shade like this, the upper portion, which is nearer the light, appears brighter than the lower portion, in consequence of which a very pleasing and attractive blend from a lighter to a darker shade is obtained.

In making the stand, prepare the square base first, and then glue on a square block at each corner, taking due care to keep all corners sharp and square. An inch and a half square hole should be cut in the center. The main post, which will require some little care, can be worked out in the rough by means of a small scroll saw. When the top and the proper taper have been formed, work out the tenon on the lower end to fit the square hole in the base, after which cut the small mortises for the handle, and bevel the edges. The making of the handle will be largely a matter of penknife carpentry. Make the two horizontal pieces first and fit them to the main post, after which carefully mark off the position of the handle proper, where a notch should be cut in each to half the depth. After notching out the vertical piece of the handle in a similar manner, the entire handle may be fitted together and made fast with glue. A hole should be drilled through the center of the main post for

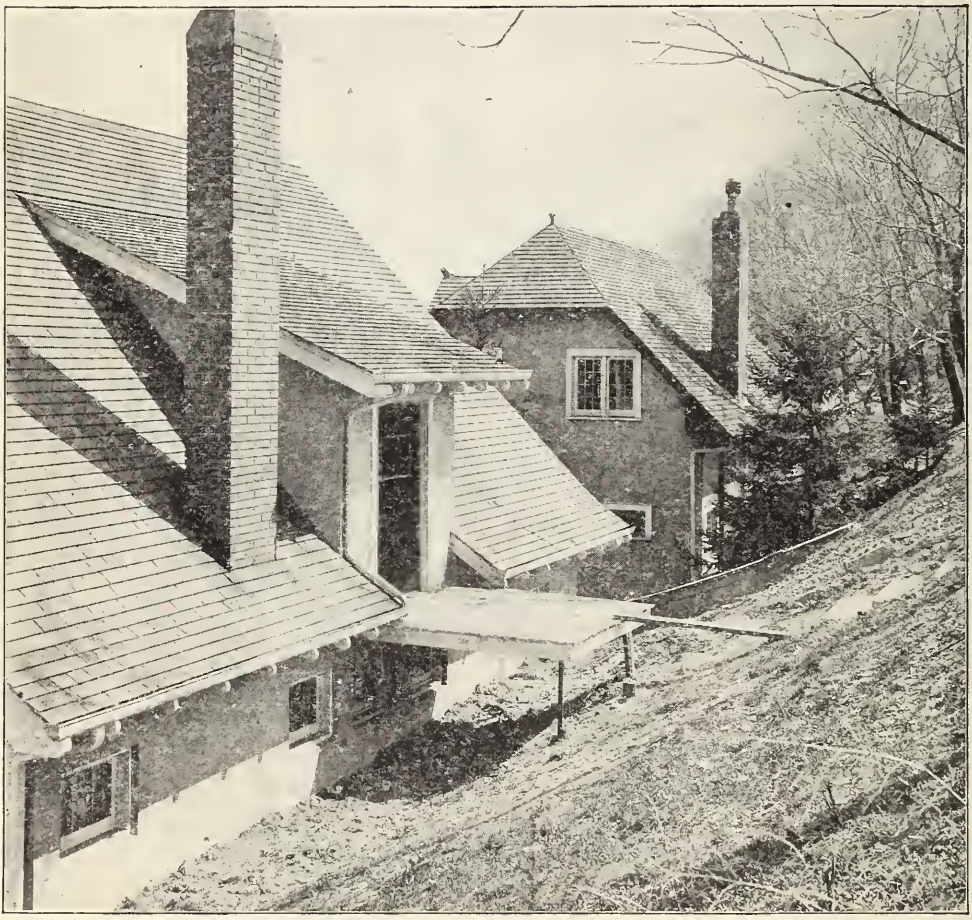


Details of Lamp

the wire, and four pieces of light brass or iron are to be procured and fastened to the top of the post to support the shade. If a sufficiently long bit is not at hand, take the stand to the nearest electrical shop, have the hole bored, and the socket, plug and cord all attached.

CURIOUS HOUSE WITH DOOR IN ROOF

One of the most curious dwellings in or around Cleveland, Ohio, is this cottage perched on the side of a hill above a stream which runs through a valley 100 ft. below.



A House Entered from the Roof

The entrance to the cottage was formerly on the other side, but the owner found the hill to be too steep to be accessible to many visitors. Therefore, he cut a hole in the roof, raised a section of roof above it, and inserted a door. A staircase leads from it into the living room.

¶The automobile industry is so rapidly using up the supply of hickory that a new wood must soon be found for spokes, rims, etc.

A GREAT SALT MINE IN ROUMANIA

This illustration shows the main shaft of a great salt mine at Slaniku, Roumania. Its present output is 78,500 tons a year, but were this to be increased to 100,000 tons the mine would not be exhausted for 200 years, as the deposit available is still about 20,000,000 tons.

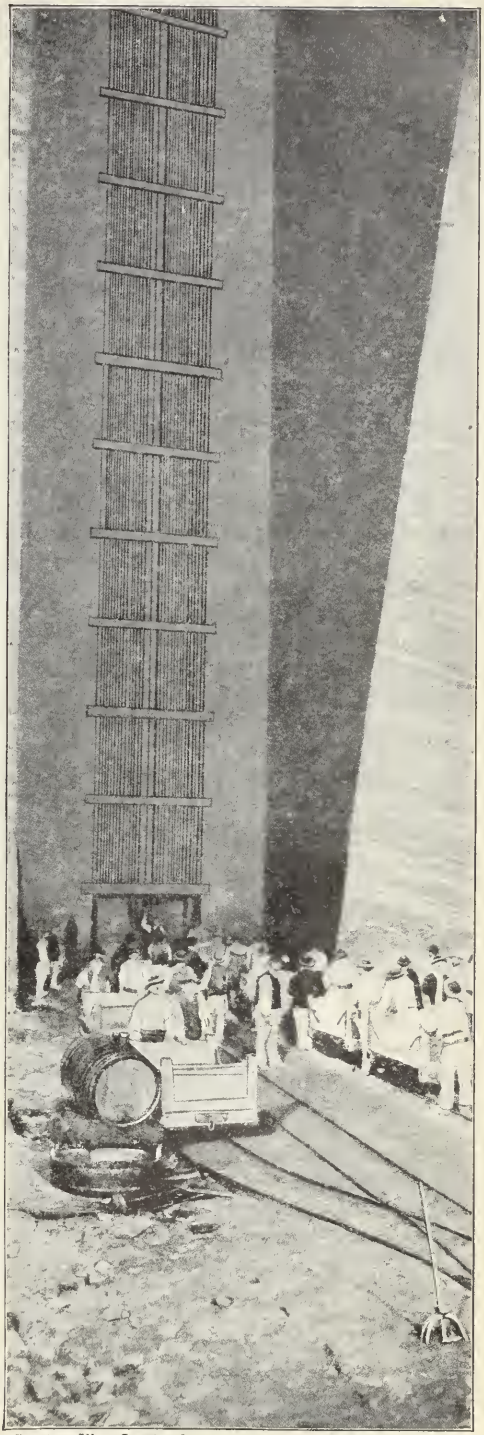
The salt of this mine is more or less colored by impurities, and has a stratified appearance. The floor of the mine is lowered about 6½ ft. each year.

FIVE-LEVEL SUBWAY STATION FOR NEW YORK

The latest plans by the New York Central & Hudson River railroad to connect its Grand Central terminal with the several present and proposed rapid-transit subways will mean a 5-level subway connecting station. The five levels underground will be those of the existing Interborough subway, the Hudson tunnel extension now under construction, the New York & Long Island tunnel, and the Broadway-Lexington Ave. subway, soon to be started by the public service commission. The latter will be double-deck at the point of the station, thus making the five levels necessary.

CONCRETE BLACKBOARDS FOR SCHOOLS

Concrete as a material for school blackboards is said to be a great improvement over any other kind of blackboard material, even slate. The foundation of the new kind of board is concrete applied to an ordinary brick or wire-lath wall. The finish is liquid concrete. It gives a smooth surface, which consumes very little chalk, and eliminates chalk dust to a great extent. Its most important feature, however, is the fact that it presents an absolutely dead finish, without reflection, making it possible to see what is on the board from any angle of the room.



Courtesy Illus. London News

Roumanian Salt Mine

Clock-Hand Problems

By JAMES ARTHUR
Author of "Time and Its Measurement"

SIMPLE calculations showing the times at which clock hands bear certain relations to each other, such as being together, forming a right angle, a straight line, or equal angles from a line drawn through XII and VI etc., have a certain fascination. They are often considered "puzzles" and appear sometimes in the weekly newspapers, but they are much higher than puzzles, and are, really, calculations in elementary algebra. As exercises in the simpler equations I do not know of anything better; still more, they lead up to calculations of the highest order, as they deal with the relations of two bodies moving at different speeds.

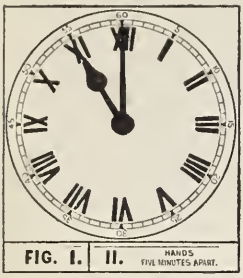


FIG. 1. 11. HANDS FIVE MINUTES APART.

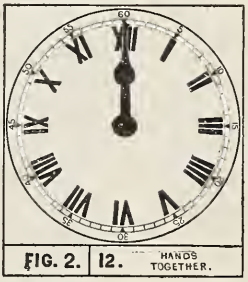


FIG. 2. 12. HANDS TOGETHER.

Clock hands give the simplest example of differential motion as they move in the exact ratio of one to twelve and thus form a first step in calculations of moving bodies, leading up to the complicated motions in the solar system. Suppose that in an equinoctial year we had just 12 lunar months; then calculations relating to new moons, quarters, etc., would be as simple as the clock hand problems; but as the year and the month are incommeasurable, that calculation requires the higher mathematics.

Figure 1 shows 11 o'clock with the hands five minutes apart. What time after 11 would bring the hands together? This looks like a childish question, but by assuming that we do not know and formally making the calculation a clearer conception of the matter may be attained.

Let X equal the number of minutes the minute hand must move. Then $X - 55$ minutes will be the distance the hour hand must move. The hour hand must move 1/12th of X, or $\frac{X}{12}$ therefore we have

(1)
$$X - 55 = \frac{X}{12}$$

Multiplying both sides by 12 we have

$$12X - 660 = X$$

Carrying the minus number to the right it becomes plus giving

$$12X = X + 660$$

Bringing X to the left it becomes minus giving

$$11X = 660$$

Therefore $X = \frac{660}{11} = 60$ minutes, so the hands come together at 12 o'clock, Fig. 2, which we knew before, but we have tested the formula.

At what time after 12 would the hands form a right angle? Inspection shows that it must be more than 15 minutes past 12. We cannot guess this answer, but as shown in Problem 1 we get the equation

(2)
$$X - 15 = \frac{X}{12}$$

$$12X - 180 = X$$
$$12X = X + 180$$
$$11X = 180$$

$$X = \frac{180}{11} =$$

16 4/11 minutes past 12 as in Fig. 3.

FIG. 3. 12-16 4/11. HANDS RIGHT ANGLE.

At what time after 12 would the hands form a straight line? Again, inspec-

tion shows that it must be more than 30 minutes past, so we get the equation

(3)
$$X - 30 = \frac{X}{12}$$

Solving as in Problem 1 we get X = 32 8/11 minutes past 12 as in Fig. 4.

You can make as many of these problems as you please, such as:

When would the hands come together after 3? What time after 4 would the minute hand pass the hour hand 5 minutes? What time before 12 would the hands form a right angle? If you have worked all these carefully you must have noticed that in all cases you have multiplied by the improper fraction $\frac{12}{11}$.

Secondly, the number so multiplied has always been the number of minutes which would give the required position of the hands if the hour hand had not moved. Now test this "arithmetical rule" on Problem 1. If the hour hand had not moved, the minute hand would have come up to it in 55 minutes, so $55 \times 12/11 =$ 60 minutes as we have found by algebra. Problem 2 treated in the same way would give a right angle at 15 minutes past, so we have

$15 \times 12/11 = 16\ 4/11$ minutes

which is the correct answer. Similarly Problem 3 would be

$30 \times 12/11 = 32\ 8/11$ minutes,

correctly, as in Fig. 4.

We have now come to problems somewhat different, which we may call balanced hands. Let us suppose a vertical line drawn through XII and VI and consider various places where the hands would form equal angles with this line.

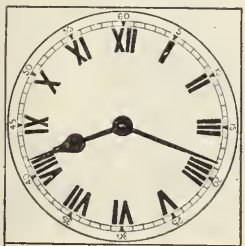


FIG. 6. 8-18 5/13 HANDS BALANCED.

At what time after 11 o'clock would the hands balance? Inspection shows that the minute hand must fall short of 5 minutes as much as the hour hand passes 55 minutes; that is, the hour hand must pass XI just as much as the minute hand falls short of I.

As before, let X equal the time; then the hour hand must pass XI one-twelfth of that, or $\frac{X}{12}$, but 5 minutes minus X must also equal this, so we have

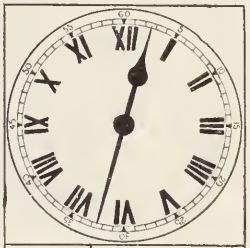


FIG. 4. 12-32 8/11 HANDS STRAIGHT LINE.

$$\frac{X}{12} = 5 - X$$

$$X = 60 - 12X$$

bringing minus 12X to left it becomes plus and gives

$$13X = 60$$

$$X = 60/13 = 4\ 8/13$$

minutes past 11 as in Fig. 5.

FIG. 5. 12-4 8/13 HANDS BALANCED.

In painting watchmaker's signs the artist sometimes "balances" the hands as in Fig. 6, but he generally fails to get them right, so let us see when the hands would balance after eight. As the time must be less than 20 minutes we get an equation similar to Problem 4

(5)
$$\frac{X}{12} = 20 - X$$

$$13X = 240$$

$$X = \frac{240}{13} = 18\ 6/13$$ minutes past eight as in Fig. 6.

Note the constant fraction 12/13 in these balanced problems, so we can get an arithmetical rule here also. Assuming that the hour hand stands still, the hands in Problem 4 would balance at 5 minutes, so we have $5X \times 12/13 =$ 4 8/13 minutes as by algebra.

Applying this rule to Problem 5 we have $20 \times 12/13 = 18\ 6/13$ minutes which is correct. As many of these balanced problems as you wish may be solved.

When would the hands balance after 3?

When would they balance after 9, 2, etc?

For simplicity I have given the time in minutes, but if answers are extended to seconds we will still have fractions.

To reduce 6/13 minute to seconds we have

$$\frac{X}{60} = 6/13$$

$$13X = 360$$

$X = 360 = 27\ 9/13$ seconds, making the answer to Problem 5, 18 minutes, 27 9/13 seconds past eight as in Fig. 6. Extending the answer as a decimal we get

$$X = \frac{360}{13} = 27.692307692307$$

seconds. This is to the ten-billionth part of a second, but there is still a fraction more, for 769230 recur in the same order, indefinitely, thus forming an endless decimal fraction, sometimes called a "mixed circulator." This is caused by the interesting fact that we are dealing with relative motions, the hour hand always moving at 1/12 the rate of the minute hand.

While this short article gives only a few simple examples, I think they are enough to show that clock hand problems constitute a charming and instructive exercise in elementary science.

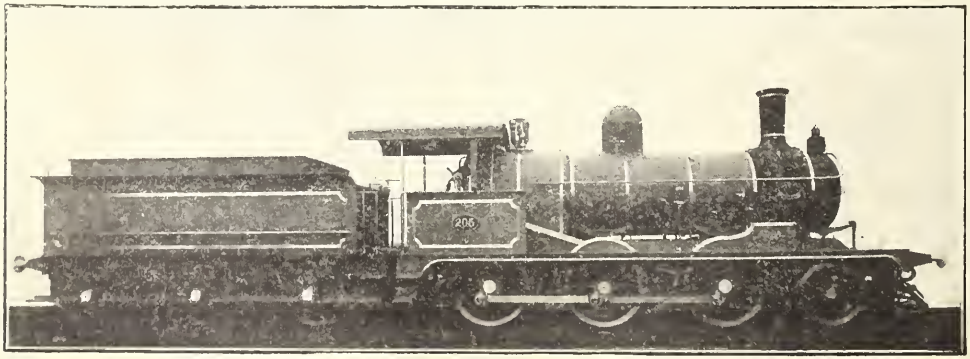
FREIGHT LOCOMOTIVE OF INDIA

This locomotive is used for freight-hauling on the Great Indian Peninsula railway. It is of the English Mogul type, with inside cylinders. The driving wheels are 4 ft. 6 in. in diameter. The cab is of an open type with a canopy overhead to protect the engineer and fireman from the sun and rain. There are several features in the exterior appearance of the locomotive that may seem curious to people familiar with the American types. A footboard, for instance, runs the whole length of the tender, and its forward end forms half of the step leading into the cab. The whistle also has an unfamiliar appearance.

ACCIDENT-PREVENTING DEVICES DEMANDED BY ITALY

That the Italian government is making a serious attempt to provide ways and means of preventing accident to its industrial workers is evinced by the money prizes offered in order to stimulate the invention of such appliances.

The prizes just offered include $2,000 for a paper on electrical earth connections; $800 for a transportable apparatus for slipping belts on pulleys; $800 for slipping a belt on a driving pulley in motion; $2,000 for the discovery of measures for eliminating the dangers of anthrax in tanneries, and $400 for a device to protect workmen on cold-rolling and drawing machines.

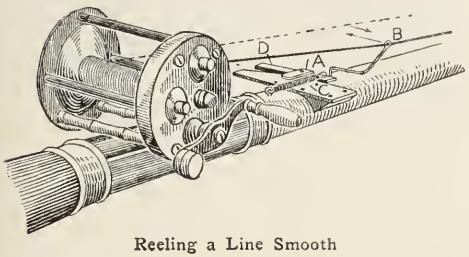


Freight Locomotive in British India

SHOP NOTES

How to Make a Reel Line Guide

A great many fishermen have trouble with their reels in casting owing to the back lash or the reel running too fast for the unwinding line. A little home-made device illustrated herewith will enable the fisherman to reel his line so it will run out smoothly. It is constructed of the clapper from an old electric bell, together with the bar and pivots to which it is attached. The striker or ball on the end is removed and the wire bent into a ring. The device is secured to the rod in front of the reel as shown. A spring is attached at C to draw the wire on one side. Thread the line from the reel through the ring at B and on to the end of the rod. In use, grasp the rod with the left hand and manipulate the lever D



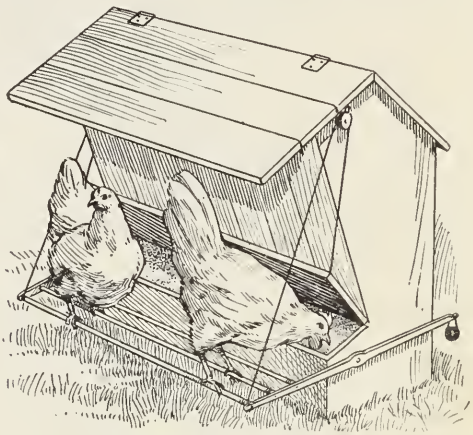
Reeling a Line Smooth

with the left thumb. The line can be wound on the reel evenly, ready for the next cast.—Contributed by A. G. Mason, Chicago, Ill.

A Chicken Feed Hopper

This hopper has some advantages that other feeding devices do not have. The automatic lid prevents the food getting mixed with dust and dirt. The fowl can open the lid at any time for eating and the food will only come in the manger as it is used. One filling of the hopper will supply food for two or three days. The fowls soon learn to use the feeder.

The hopper is 8 in. wide, 2½ ft. high and 3 ft. long. The roof projects over

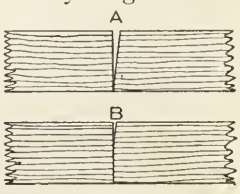


Chicken's Weight Operates Lid

the perch and hopper. The cords are attached to the lid of the manger and to the perch, running over pulleys fastened near the roof, as shown in the illustration. The perch is fastened on two cross bars pivoted to the ends of the hopper. The back ends of these cross bars are weighted so as to close the lid when no fowls are on the perch. The weight of one fowl will raise the lid.—Contributed by Warren Lewis, Butte, Montana.

Fitting the Ends of Two Boards

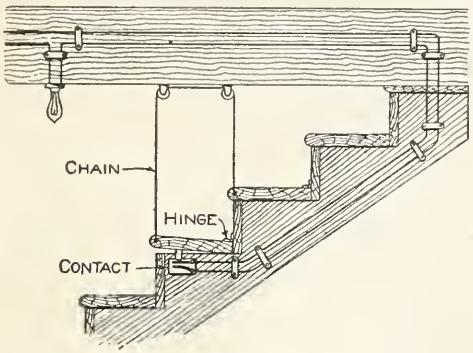
Many times in splicing boards the ends do not fit closely together as shown at A in the accompanying sketch. A simple way to remedy this is to hold them tightly together



and saw through the joint one or more times with a saw until they come together square as shown at B.—Contributed by Victor Metzech, Chicago.

Automatic Switch for Basement Lights

The electric basement light is many times forgotten and left burning when not in use, and sometimes allowed to



Steps Operate the Switch

consume current all night because some one did not turn the switch after arriving at the top of the stairs. Basements in stores are usually lighted in this manner and the electric lights are left burning many times by some clerk who is in a hurry and does not stop to turn the switch.

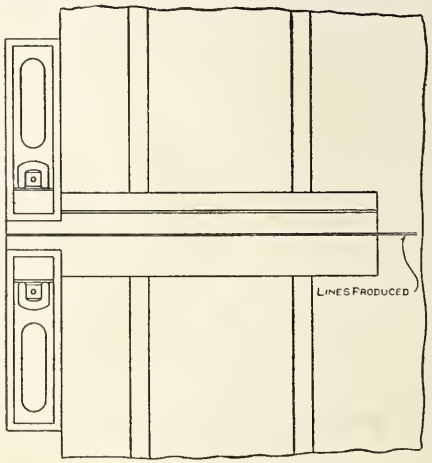
I constructed the device as shown in the sketch to take care of the electric light in my store basement. It would work automatically, turning on the current when anyone would go down the steps and turning it off when he came up. The main electric wires were connected up to a switch located near the end of one of the steps, about four or five steps down from the top. Two of the steps were hinged at the back and their outer edge fastened to a chain that ran over two pulleys screwed into a joist above. The chain was of such a length that when the front edge of one step was up the front edge of the other was down. When a person would go down the steps to the basement the lower hinged step would be pressed down last, thus making the connection for lighting the lamp. When going up the upper hinged step would be pressed down last thus breaking the connection and turning off the light.—Contributed by F. G. Christensen, Santa Rosa, Calif.

Keeping Paint Out of Oil Holes

When painting the automobile body and chassis be sure to stuff the oil holes with felt or waste before applying the paint. If this caution is not observed the holes will become clogged with paint which will prevent any oil reaching the bearing.

How to Prove a Try-Square

Try-squares of the removable blade type need occasional adjustment and where a standard square is not kept to prove them, they can be set by the method shown in the accompanying sketch, which will be found to be accurate enough for all but the finest kind of work. Remove the burrs from the edge of a planer table or any flat surface with a perfectly straight edge, and cover a strip, at right angles to the edge, about 1 in. wide and the length of the square blade, with a copper solution or powdered chalk. Place the beam of the square against the edge of planer and with a sharp scriber draw a line along the edge of the blade. Reverse the square as shown and draw another line close to the first and any



Testing the Square

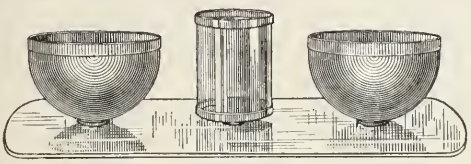
inaccuracy in the tool is apparent at once and can be corrected to a nice degree.—Contributed by Donald A. Hampson, Middletown, N. Y.

Oak Stain

An easy, and at the same time, a good way to stain oak in imitation of the fumed effect, is to boil catechu in the proportion of ¼ lb. to 6 lb. of water, after which cool and strain. Apply this to the wood, and when dry treat with a solution of bichromate of potash in the same proportion as with the catechu. Bichromate of potash alone in water will give a good stain. A solution of 2 oz. of pearl ash and 2 oz. of potash mixed in a quart of water makes a good stain. Potash solution darkens the wood, and when applied very strong will produce an almost ebon hue, due to what we might describe as the burning of the wood fiber.

Smoker's Set for the Engine Room

Procure a brass plate, two brass oil cans and one oil cup. Remove the bottoms from the cans so they can be used



Cup and Cans Mounted

for covers and then fasten the cans bottom up to the brass plate, or they can be screwed or bolted to a piece of mahogany. Attach the oil cup in the same manner. When the parts are polished the set will be very odd and attractive. —Contributed by Maurice Baudier, New Orleans, La.

Easy Way to Climb Poles

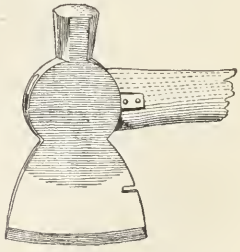
When one wishes to climb a flag pole it will be found very hard to do so with the shoes on the feet. The simple way illustrated makes it easy to climb a pole. The shoes are taken off and a handkerchief with two opposite corners tied in a square knot as shown in the corner of the sketch, slipped over the feet and up around the ankles. In climbing the pole, spread

Ankles Tied Together

the knees apart, thus forming a grip against the pole with the insteps similar to a pair of pliers. A person can take long leaps with much ease in going up. The handkerchief is shaken off when you start down.—Contributed by John Blake, Franklin, Mass.

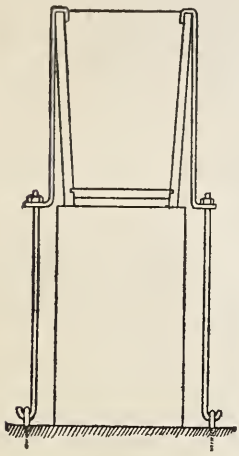
A Wedge for a Hatchet Handle

If a hatchet will not stay on its handle, take a piece of iron, $\frac{1}{16}$ in. thick, ½ in. wide and 3 in. long, bend a small portion of one end over at right angles and drill two small holes near the other end. Place this piece of iron between the handle and the hatchet with the end turned over on top of the metal part, then put two small screws through the holes into the handle. It may be necessary to make room for the wedge. This can be done by cutting a small groove in the handle with a chisel. The end turned over on the wedge should not extend over the side of the hatchet. This wedge makes it impossible for the hatchet to slip off the handle.—Contributed by Andrew Thome, Louisville, Ky.



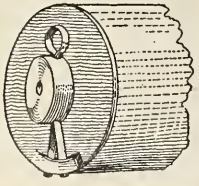
Clamp for Holding an Ice Cream Freezer

It is always harder to hold an ice cream freezer than to turn it, yet very few persons think of rigging up a holding device. Clamps can be easily made, as shown in the accompanying sketch, to hold the freezer on a box or block at a height which will facilitate the turning of the crank. The upper bars are made of ¼ by 1-in. flat iron, bent as shown, and a ⅜-in. hole drilled in the bottom end for a rod. The rods are long ⅜-in. bolts with their heads cut off, and a short hook turned up on that end. Two ¼-in. screw eyes are screwed into the floor to receive the hook ends of the rods. It is best to oil the threaded ends of the bolts after using the freezer to prevent the salt water from rusting them.—Contributed by F. C. Bachman, Sherman, Texas.



Preventing the Wear on a Cotter

Where a cotter is used to hold a washer on the end of a shaft and a revolving hub of a wheel runs against the washer the latter often turns with the wheel and in time wears the cotter off. To prevent this I locked the washer and cotter in the following manner. A cut was made through the washer about ¼ in. from the edge and about 1 in. long. The strip was bent up and when the washer was put in place the strip was then bent down over the cotter as shown in the sketch.—Contributed by Thos. L. Parker, Olaf, Iowa.



Cost of Repainting Automobiles

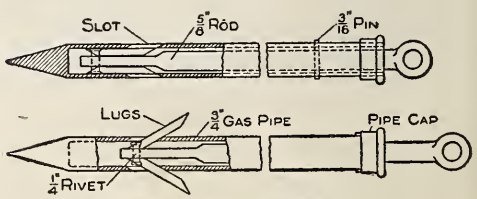
The average paint shop does not have data on the price to charge for repainting and varnishing automobiles. As this is a new line of work that has come to stay, the profit should not be cut, as is too frequently the custom on carriage and wagon work.

The following list of prices has been compiled by the American Vehicle, which represent the cost of work as charged by the regular automobile painters:

Revarnishing Limousines	$ 65.00
Painting and Varnishing Limousines	100.00
Burning off, Scraping and Painting up Limousines	125.00
Revarnishing Touring Cars	45.00
Painting and Varnishing Touring Cars	75.00
Burning off, Scraping and Painting up Touring Cars	100.00
Revarnishing Runabout Cars	25.00
Painting and Varnishing Runabout Cars	45.00
Burning off, Scraping and Painting up Runabout Cars	65.00

A New Metal Tent Stake

A novel home-made tent stake is shown in the accompanying detail sketch. If it is well made it is far superior to the straight wood or iron ones commonly used. The body is made of ¾-in. gas pipe and should be about 2 ft. long. Heat one end and draw it down to a solid point so that it will drive easily. Thread the other end for a pipe cap as shown. The rod is made of ⅝-in. round iron, has an eye at one end, and is flattened at the other.



An Anchor Tent Stake

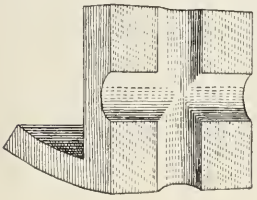
Make two lugs or prongs out of ¼ by ½-in. iron, each 2¼ in. long and taper the ends as shown. One end of each of these lugs should be drilled and countersunk for a ¼-in. rivet which fastens them to the flattened end of the rod and has play enough to allow them to fold against it. Two square holes should be cut in the pipe about 8 in. from the pointed end to allow these

lugs to extend through when they are spread. A pin fastened in the rod near the top end and working in a slot in the pipe regulates the upward and downward movement of the rod and also keeps it from twisting when the pipe is being driven. The cap at the top is to drive upon when setting the stake, and care must be taken not to hit the eye at the end of the rod.

After the stake has been driven into the ground, pass a rope through the eye and tighten. The upward movement of the rod spreads the lugs which catch the surrounding earth. The stake should be inclined towards the tent when it is being driven, so the rope will pull endwise upon it. The stake can easily be removed from the ground by pushing down upon the rod, thereby folding the lugs against the rod, and pulling up on the pipe.—Contributed by N. C. Best, Chatham, Ontario, Can.

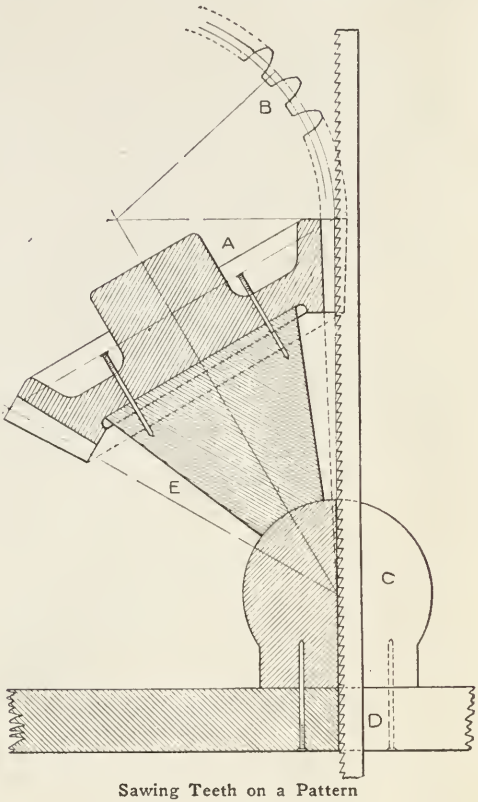
Pipe Holding Jaw for a Vise

Where a limited amount of pipe cutting and threading is done the tool illustrated is a very good substitute for a pipe vise. It is made of steel to fit the jaw of an ordinary vise, and it has two half round grooves cut for holding the pipe in two positions. Teeth may be cut in the grooves for gripping the pipe.—Contributed by C. Purdy, Ghent, Ohio.



Cutting Gear Teeth in Patterns on a Band Saw

A device whereby the teeth in bevel gear patterns can be cut on the band saw, is shown in the accompanying sketch. With this device the teeth can be cut much more accurately and quickly than shaping them by hand. Having the blank gear pattern, A, turned to the proper size, lay out the teeth on the pitch line as shown at B. Turn up a round ball, C, in the lathe,



Sawing Teeth on a Pattern

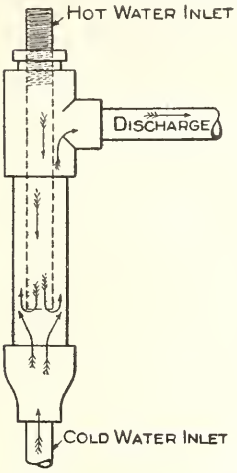
and fasten it to a board, D, with nails as shown.

Turn up a cone, E, of the proper length and hollow out one end to fit this ball. Fasten the blank gear to the cone, being careful to get it exactly in the center. Saw through the board and fasten the board to the saw table in this position. By holding the cone ball to the exact center of the ball and against the ball the teeth can be sawn out according to the layout on the blank. This device is also very handy for making experimental wooden gears. —Contributed by J. C. Hansen, Chicago, Ill.

It is best to carry a plan of the wiring system on your automobile. The owner of each car can draw up such a plan, if the manufacturers do not supply one with each machine.

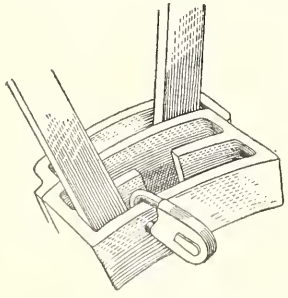
Hot and Cold Water Mixer for Shower Baths

Did you ever take a shower bath and have the temperature of the water just right for a time, and then suddenly get a dash of either cold or hot water? This is caused by the improper mixing of the hot and cold water. Good mixers are expensive, and therefore few baths in private homes are equipped with them. The mixer shown in the accompanying sketch requires very little explanation. All that is required is one reducing coupling at the bottom, a reducing tee at the top and an inside pipe with a long thread as shown in the illustration by the dotted lines. The cold water entering the bottom meets the hot water descending and both are properly mixed when they leave the discharge.—Contributed by James E. Noble, Toronto, Canada.



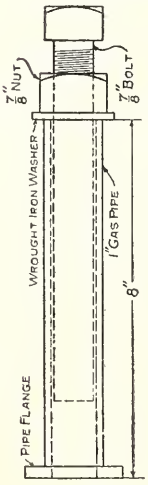
Locking a Motor Car

Owing to many motor car thefts which have occurred recently in various parts of the country it behooves every owner to adopt some plan for locking his car. A good method, illustrated herewith, consists of drilling a hole through the side of the quadrant in which the gear shifting lever operates, so that when the padlock is in place as shown, the shifting lever cannot be disengaged from the slot in which it rests. In this case the gear shifting lever is confined with the reverse gear in mesh, so that the car can only be run backward, says Motor Age. On some cars the lever can be locked in the neutral position so that it could not be run at all under its own power, but it could be readily taken in tow. Special lugs have been fitted to the gear-shifting levers and quadrants on some cars for this purpose, and almost any car with a gate type quadrant can be rendered nearly theftproof by anyone as above described.



A Home-Made Jack Screw

The accompanying sketch shows a small jack which is cheap, simple and quite useful in the shop. All that is required is a ⅞ by 8-in. bolt, one washer, a piece of 1-in. gas pipe, 8 in. long, and half of a 1-in. pipe flange. It is astonishing how much this little jack is capable of raising, says a correspondent of the Practical Engineer. It does not require over 10 min. to make.



How to Repair Steel Tapes

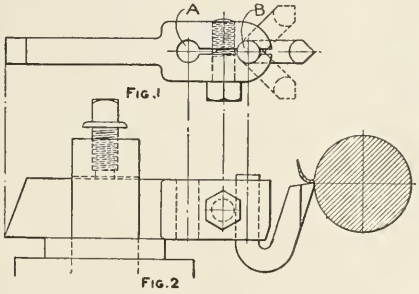
The ends of the tape left by the break must be straightened out with a pair of pliers and joined together, end to end, so as to leave the length unchanged, says Engineering News. Bend a strip of tin ½ in. wide around the joint and clamp it down firmly with the pliers. Put a few drops of soldering acid solution and a small piece of solder on the joint; hold over a burning candle or any small blaze until the solder melts. A small pine stick may be used to spread the solder and make it run into all the seams.

A field repair outfit to be carried in a civil engineer's transit or level box is made up of a vial of soldering acid, solder, a small pair of steel pliers and a few old tin can seals. The soldering acid can be made by dissolving zinc in muriatic acid to saturation. With these conveniences a civil engineer can keep his tapes in good repair.

An Adjustable Lathe Tool Holder

The accompanying illustration shows a lathe tool and holder I have been using for the past year with success. The holder is forged to the proper size for the tool post and two ⅜-in. holes, A and B, drilled ¾ in. apart. The two holes are connected by cutting a slit with a hacksaw using two blades. This allows the metal to spring enough for holding the tool secure with the screw. The cutting tool is made of a piece of round tool steel the same size as the diameter of the hole drilled in the holder. The proper shape of the tool is shown in Fig. 2. The screw should be made of ⅜-in. steel. It is not necessary to change the tool post to adjust this tool. The different positions can be obtained as shown in Fig. 1 without having to use several tools.

This tool makes an excellent thread cutter and one that will give the desired pitch with little adjustment. The entire tool when finished should be

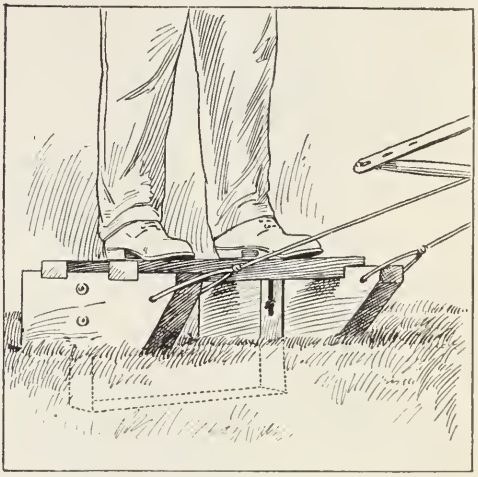


Tool Can Be Used in Different Positions

about 3½ in. long. A very good plan is to have a number of cutters made, each having a different cutting point. —Contributed by J. N. Bagley, Webber, Kan.

Cutting Soil for Sodding

The construction of the sod cutter is clearly shown in the sketch. It may be well to add that the knife blade



Cutting Sod

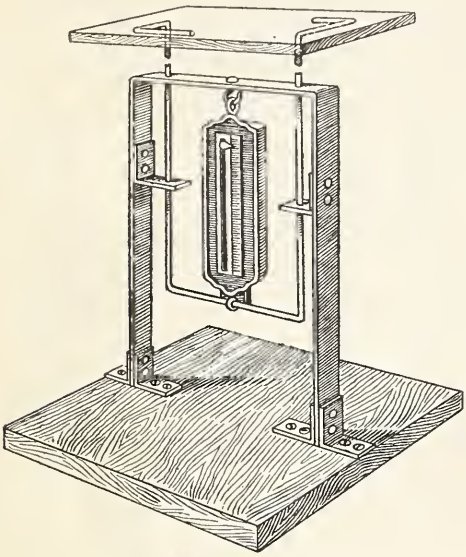
dips downward about ⅜ in. in its width of 2½ in. The knife can be adjusted to cut the sod at the proper thickness. Two men and a boy with a team cut enough sod to load a slat wagon holding 1¼ cu. yd., rolled the sod, and loaded the wagon in a trifle over an hour. The cutter is easily and cheaply made, and is a great improvement over the spade.

Temporary Automobile Tire Repair

A motorist had a bad blow-out in one of the front tires of his machine when out in the country, and not having an extra shoe along to make a change, he called on a farmer and secured a quantity of oats and a small piece of an old feed bag. The injured tube was removed and the shoe stuffed tightly with oats, the piece of bagging being placed on the inside of the shoe to prevent the oats from coming out. In this way he was able to drive to the city garage without running the car on the rim and further injuring the shoe. This would probably work only on the front wheels.—Contributed by Donald A. Hampson, Middletown, New York.

Platform Scale Made from a Spring Scale

The scale as shown in the sketch was made to weigh articles that could not be hung on the hook of a spring



Scale Mounted on Stand

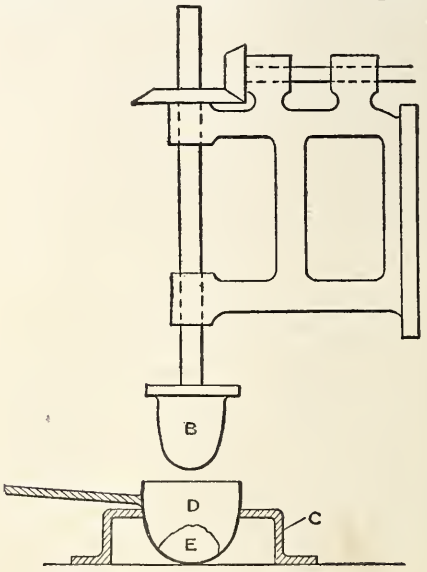
scale. The base of the scale is made from a piece of board 8 in. square to which is attached a frame made of strap iron, 1 in. wide, whose uprights are 11 in. high. The top part of the frame is 6 in. wide. A hole is drilled in the middle of the top piece and the hook taken from the spring scale fastened into it. The spring scale is hung on this hook.

The lower part or movable shaft of the spring scale is attached to a U-shaped piece of ¼-in. wire whose uprights are 10 in. high and the crosspiece 4 in. long. The upper ends of the wire are bent as shown by the dotted lines and attached to a board ½ in. thick and 6 in. square. The length of the wires between the top board and the top of the iron frame should be a little longer than the distance traversed by the needle over the face of the scale. The uprights of the U-shaped wire run through guides riveted to the frame and through the top part of the frame as shown. Adjust the pointer to zero and the platform scale is ready for use.—Contributed by John Blake, Franklin, Mass.

Daubing Foundry Hand Ladles

In a certain large cast-iron soil-pipe foundry, where it formerly kept three men busy "daubing" ladles, the superintendent has introduced a cheap machine to do the work so that now one man can in one hour daub all the ladles required for the day's work.

The cut shows the device. An old fashioned drill press was bought second hand. The spindle has a travel of about 13 in. and is provided with a simple lever feed, not shown. To the end of the lever the turned cast-iron former, B, is fastened. This former is made the shape of the inside of the finished daubed ladle, says the American Machinist. The spindle and former are counterbored. A roughly made iron centering device, C, centers the ladle D. A piece of loam, E, is put in the bottom of the ladle and the quickly rotating former is brought down against



Forming Mud Ladle Linings

it. The surplus loam is forced up the sides and over the edge. The finished daubed ladles are much neater in appearance as the work is more uniform than hand daubing.

Aeronaut's Hot-Air Balloon

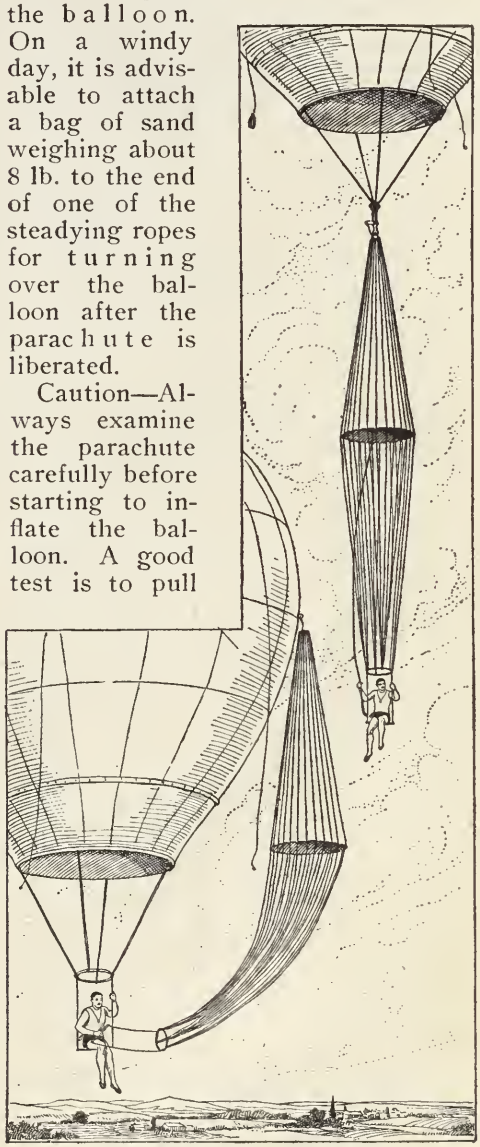
Part III—How to Descend in a Parachute

The first description is for the "leap-off" method. When the balloon is filled as described in a previous chapter, fasten a ring 2 ft. in diameter to the ends of the four 12-ft. ropes attached to the ring sewed into the cloth at the bottom end of the balloon. Attach a trapeze to this lower ring with two side ropes each about 3½ ft. long. Attach the parachute top to a small ring that has been fastened half way up the side in the cloth of the balloon for this purpose. Tie it to the ring with a cord or string that will break with a weight or strain equal to about 75 lb. The parachute described in a previous chapter will weigh about 35 lb., if made of the same material as the balloon. The cord or string will hold the parachute until the aeronaut makes his leap. The extra weight applied breaks the cord or string and the passenger drops rapidly until the parachute opens. The balloon, being relieved of its weight soon turns over, empties the hot air, and then drops to the earth. When using this "leap-off" method it is necessary to fasten yourself securely to the trapeze of the balloon for safety.

When using the liberating knife the four 12-ft. ropes attached to the ring fastened in the cloth at the lower end of the balloon are tied into a loop. Pass a strong cord through this loop and through the knife hole in the liberating knife and tie securely. Fasten the parachute top to the bottom of this knife. Fasten a cord to the handle of the knife blade and pass the loose end through the hole in the top and down inside of the parachute within easy reach of the aeronaut sitting on the trapeze.

When the altitude desired is reached the cord is pulled to cut the fastening cord and the parachute drops rapidly until it opens. Then you descend to the earth slowly. This is the safest method of the two as you ascend fastened to the lower part of the parachute, the parachute attached beneath the balloon. On a windy day, it is advisable to attach a bag of sand weighing about 8 lb. to the end of one of the steadying ropes for turning over the balloon after the parachute is liberated.

Caution—Always examine the parachute carefully before starting to inflate the balloon. A good test is to pull



Two Methods of Using a Parachute

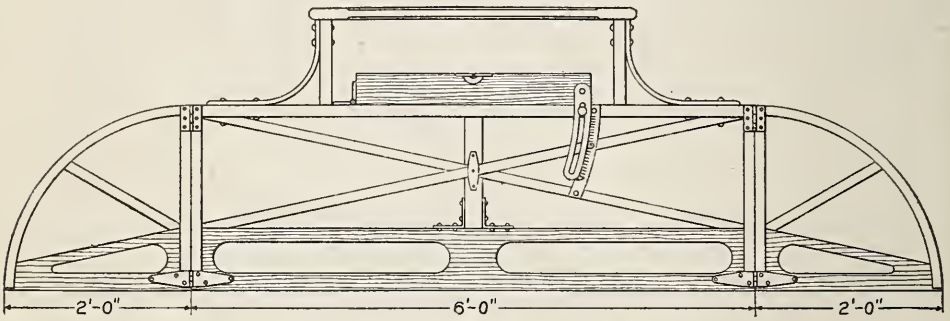
the cords and cloth against the wind allowing it to open to its full extent. Be careful to see that the parachute cords are straight and not tangled when at-

taching it to the balloon. When using the last described method of attaching the parachute to the balloon always look above your head and see that the cords are straight and not twisted around under the cloth end. Sometimes the cords become twisted as you ascend. If you cannot get them straightened while in the air do not cut the parachute loose.

A Grading Level

A handy tool for general leveling and for grading streets, or for setting curbs, pipes, ditches and the like to any desired grade, is shown in the accompanying sketch. It is so simple as to hardly need a description, says a correspondent of the Engineering Record. A light, rectangular frame of wood, stiffly braced, has for its lower member a board 8 in. wide and 6 ft. long, with framed end pieces, each 2 ft. long, hinged as shown. When extended the board is 10 ft. long and held in position by latches, not shown in the sketch. The lower edge of the board is shod with a thin strip of steel.

It can be used with greater ease, speed and accuracy than the ordinary leveling board.



Level as Well as Degree of Elevation Can Be Found

Centrally located on its upper member is a carpenter's level, hinged at one end and provided at the other end with a pointer and set screw which passes through the slot of an arc in the pointer. The pointer shows on a fixed graduated plate the degree of elevation, in inches per hundred feet, or the per cent of grade required. Above the level is a handle for carrying it from place to place, but the handle may be dispensed with if used in a low tunnel or other confined place.

The apparatus can be constructed in a short time by any good carpenter.

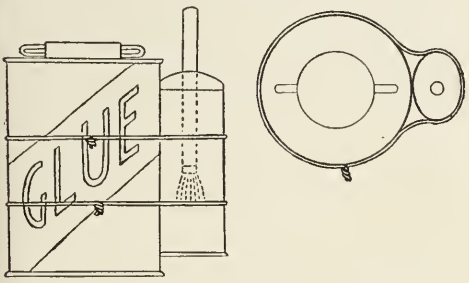
Varnish on Automobile Bodies Spoiled in Washing with Soap

The use of needlessly strong alkali soap in cleaning automobiles, neglect to wash off the soap and failure to dry the varnished surface perfectly are probably responsible for more damage to paint and varnish than all other causes combined, says Automobile Dealer and Repairer. As a matter of fact, neither soap nor water should ever be used on an automobile above the under sides of the mud guards, except in cases where the mud is caked on the body in large quantities. In most cases the first signs of wear on the painted portion invariably show on the varnished portions of the engine bonnet. This is due to the fact that it is frequently covered with mud on the return from a run and is then washed with soapy water while the metal is still hot. Soap should not be used on the bonnet until it has cooled.

¶It is not economy to save emery wheels by neglecting to keep them true and sharp.

Glue Brush Holder

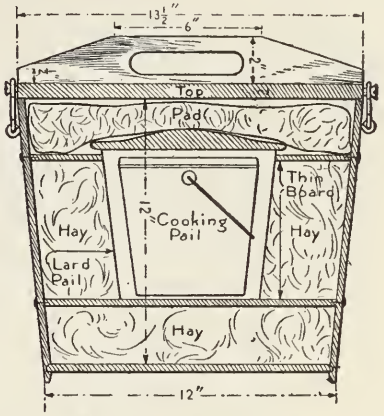
Many a small shop uses glue in quantities too small to necessitate a regular equipment of melting-pot, double boiler, etc. In such cases liquid glue proves a handy and efficient substitute. The small "trial size" bottle, with the brush fitting through a metal cap which replaces the drawn cork, is too small, and on the larger size the cap is so big that it would be cumbersome if used in this way. As a result the brush, or wooden paddle which is sometimes used, becomes hard with stiffened glue. Illustrated herewith is an attachment which may be quickly made and which will keep a brush at all times soft and clean. It consists of a long narrow tin case, such as is used for holding a small bottle of liquid courtplaster, etc., wired to the glue-pot. The cover of the tin case is perforated and the brush handle stuck through. The little "burrs" around the edges of the hole are then bent down close to the brush, which grips firmly and makes a watertight connection. This case is then filled with water. If the case leaks and no solder is handy, a little melted beeswax poured inside will stop all the cracks.—Contributed by C. W. Nieman.



Keeps the Brush Soft

Home-Made Fireless Cooker

A practical fireless cooker, as shown in the illustration, can be made by using a common candy bucket, two lard pails—or any vessels having clinched lids. Place chopped hay or straw in the bottom of the bucket over which put a piece of composition board or a thin piece of box board cut round to fit the inside of the bucket. Insert the lard pail and pack chopped hay around it. Lay another piece of composition board over this, having first cut a hole through it for the top of the lard pail. Force the composition board down over the hay and hold it in place by tacking through the sides of the bucket. Make this piece flush with the top of the lard pail.



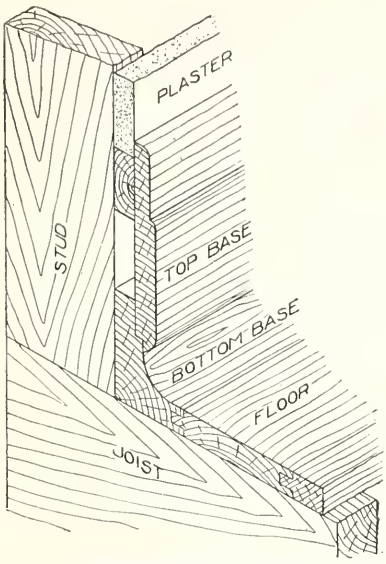
Made From a Candy Pail

Make a pad out of a piece of carpet or other heavy material and stuff it with hay to cover over the vessels. The top of the candy bucket should be fastened to the sides with three hooks and eyes. A handle may be screwed to the lid of the bucket which also serves as a cleat to keep the lid from warping. The lard pail in which the food is cooked, before placing in the cooker should be smaller than the one remaining permanent in the bucket and the bail, if too large, may be cut off and reset in the sockets. The time for cooking foods as applied to commercial fireless cookers should be used, and the results will be exactly the same. The cost of making such a cooker is practically nothing.—Contributed by Harry Sowden, Colome, S. D.

¶Emery wheel arbors should be fitted with flanges or washers having a slight concave to their face.

A New Type of Baseboard

In finishing the interior of dwellings the right angle corner formed by the baseboard and the floor, either with or



Solid Bottom Corner Base

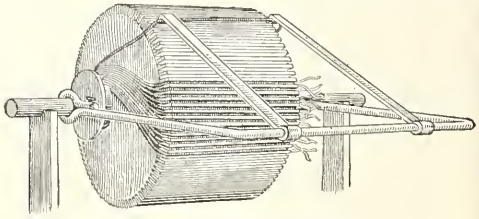
without a quarter round, has never been quite satisfactory. The square corners catch the dirt and the pieces forming it have a tendency to warp and form cracks. The accompanying sketch shows a new type of a two-piece baseboard which entirely eliminates these troubles. The lower piece joins the flooring and is laid with it, while the top piece is put on after the interior is finished. When complete it has a very neat and pleasing appearance, and it is also sanitary.—Contributed by F. W. Haglock, Akron, Ohio.

A Temporary Repair for a Broken Lamp Glass

If the glass of the tail lamp breaks, there are two ways by which immediate progress is rendered possible. The first is to procure a sheet of thin red tissue paper at a stationer's and to tie it over the frame which held the glass. As there is no head draft against the tail lamp, this is practicable, says Automobile Dealer and Repairer. A second method, which applies to any lamp on the car, is to get a sheet of thin paper, double it, grease it, and lash it over the lamp front with a wire. This is sufficiently transparent to allow of legal limit traveling with a single acetylene headlight, and at this pace a double layer of the paper is windproof for a good many miles.

Armature Coil Puller

The accompanying illustration shows an armature coil puller which has been found a convenient device for building armatures. The bar upon which the hooks are placed are of cold rolled steel, while the hooks are of flat strips of iron. The hinged loops at the ends of the bar are slipped around the armature shaft as shown, the pinion on the shaft being held rigidly by a double-jawed spanner. The hooks then grip the coil from the inside, and a downward pressure on the bar pulls the coil into position. Where the coils are very thin, consisting of but one layer of wire, a split hook will be found advantageous, says the Electric Traction Weekly. To protect the coils as they are being drawn over the slots, a strip of sheet iron 3 or 4 in. wide is bent to fit the surface of the core, being allowed to project over the sides ¼ in. This will effectually guard the coils from injury. No dimensions are here given, as it is advisable to make the puller to fit the work on which it is to be used. One thing to be observed,

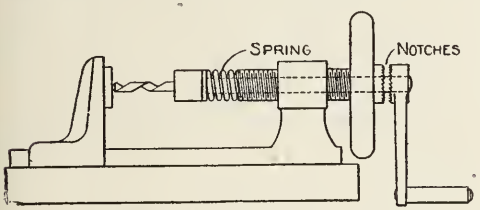


Pulling a Coil Into Place

however, is that the length of the hooks from the centers on which they swing should be the same as the distance from these centers to the center of the armature shaft.

Self Feed for a Hand Drill

The one disadvantage of the ordinary blacksmith's hand drill is the lack of a self feed, and especially so when it is necessary to hold the article being drilled with the free hand. To overcome this difficulty I designed the device shown in the sketch. I secured a coil spring about 1 in. long and placed it on the shaft between the chuck and the feed screw. I cut notches in the hub of the hand wheel and corresponding notches in the hub of the crank. When the pressure of the bit on the piece being drilled becomes too light the spring draws the crank into contact with the hub of the hand feed wheel and the teeth meshing causes the feed wheel to revolve until the



Hand Feed Changed Into a Self Feed

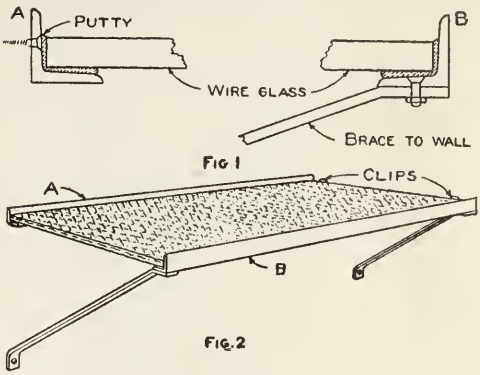
pressure of the drill pushes the crank free again. The spring also causes a more even cutting pressure.—Contributed by Thos. L. Parker, Olaf, Ia.

Home-Made Glass Drip Board for a Sink

The glass drain board shown in the accompanying sketch has several advantages over the ordinary kind, the principal one being that it prevents insects from hiding on the under side.

The drain board proper is of ⅜-in. wire glass, such as is used in fireproof buildings, set in angle irons as shown. The angle iron A is fastened to the wall with screws. The outside angle iron B is held in place with two braces of iron bent as indicated. The glass is set in putty placed in the angle of the irons. This is shown in Fig. 1. The complete drain board is shown in Fig. 2.

The strength of the glass is sufficient to stand ordinary usage, but care must be taken not to set very hot pots on it. Plate glass can be used instead of

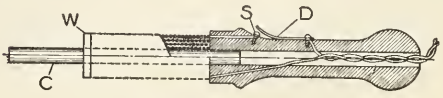


Glass Set in Putty

the wire glass but the thickness should not be less than ½ in. The wire glass is the best to use.—Contributed by A. P. Connor, Washington, D. C.

A Lifting Magnet

A handy little magnet that can be used for lifting small objects out of holes, etc., is shown in the accompanying sketch. The core, C, is made of ¼-in. diameter soft steel. The wood handle has a ¼-in. hole through its center in which one end of the core is driven. A fiber washer is placed on the core in the position shown and the space between it and the handle wound with No. 26 single cotton-covered wire. Fasten one end of the wire under the head of the screw S and connect the other to the battery. The return wire is fastened to the spring D, which is held in position by a screw. By pushing down on the spring

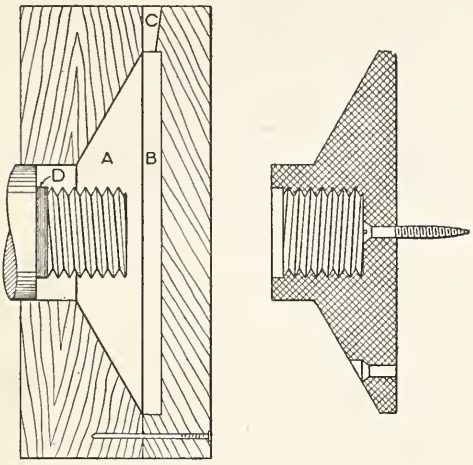


For Lifting Objects from Holes

with the thumb the circuit is completed and the core magnetized. This little magnet will prove very useful on a toolmaker's bench.—Contributed by C. G. Smith, Brooklyn, N. Y.

Faceplates Made of Babbitt

Many pattern-makers and woodworkers are using faceplates made of babbitt on their lathes, instead of the



Mold and Faceplate

usual iron ones. They are easy to make and give as good service as the others.

Make a temporary faceplate by boring a hole in a 2-in. piece of plank and screwing it on the lathe spindle. Upon this the two pieces A and B, shown in the accompanying sketch, are shaped. Fasten the two together with nails or glue, thus forming a mold. Bore a hole, C, at the top for pouring and venting. Wrap some string tightly about the spindle at D as shown, then adjust the mold in place. After pouring remove the mold, turn the faceplate true, and bore holes for the screws. Any number of plates can be taken from this mold, and by slightly changing it several different designs can be made. —Contributed by P. H. Campbell.

Engineers' Stethoscope

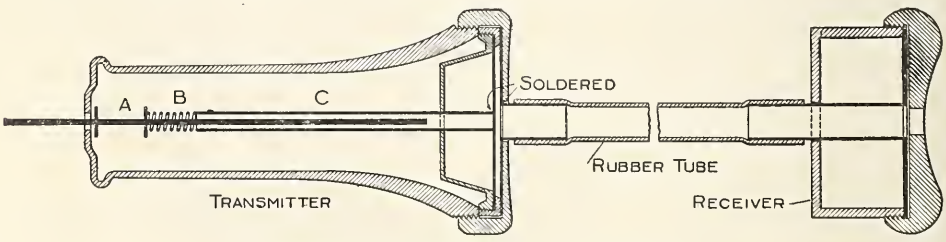
The majority of engineers are, no doubt, familiar with the physicians' stethoscope, the little instrument which is placed over the heart or lungs of a patient for the purpose of discerning any irregularities that may be present more clearly than would be possible with the ear alone. The instrument is primarily an intensifier.

A useful instrument, which for lack of a better name we shall call a stethoscope, is being used to advantage by many practical engineers, says a correspondent of Power.

By its use the engineer can more readily detect existing errors than is possible by means of the ear. Its use has been found valuable in detecting loose follower bolts or nuts, broken snap rings, leaking pistons, etc. In the examination of flywheels for fractures or loose bolts it is also found useful. The mere ring of a hammer blow is oftentimes deceptive when the unaided ear is depended upon to catch the sound.

Engineers sometimes put one end of a pencil or rule between their teeth and hold the other end against a water or steam line to determine if the flow is normal. The same principle is made use of in the stethoscope.

The material for its construction can be obtained for practically nothing at a telephone exchange. New material is not necessary, as old, slightly-cracked receiver shells will answer the purpose. The accompanying sketch shows the detail construction of the apparatus. The rod A is placed against the cylinder, water pipe or flywheel



Instrument for Detecting Errors in Machinery

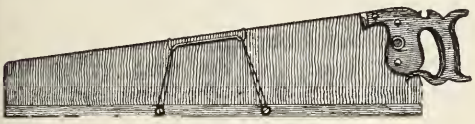
rim, while the small receiver is placed to the ear. Better results will be obtained if two small receivers are used. The connections are made of ¼ or ⅜-in. rubber tubing.

The small spring B is inserted between the rod A and the tube C to prevent pressing the rod A so tightly against the object being tested that slight vibrations cannot be detected. The faint sounds caused by the existing error are transmitted through the rod and tube against the regular telephone receiver diaphragm. The sounds, here intensified, are conducted through the tube connections to the diaphragm in the small receiver.

Any engineer can make this instrument during spare time, and its regular use may save serious accidents.

Handsaw Guard

The accompanying illustration shows a guard to place on handsaws for carrying them in crowded streets and cars. The guard also prevents injury to the teeth when the saw is placed in with other tools. It is made of a small grooved stick, four large

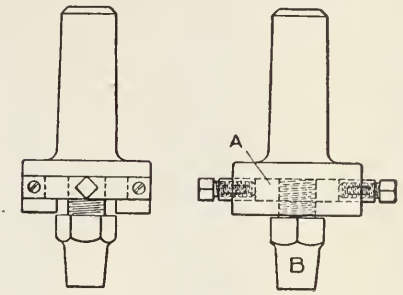


Protecting the Teeth

rubber bands, four screws, a piece of wire and some washers. The wire is bent in such a way as to fit over the back of the saw blade and have two loops on each side for the rubber bands. The guard can be slipped on and off the saw quickly.—Contributed by W. A. Jaquythe, Richmond, Calif.

An Adjustable Guide Pin for Profiling Machines

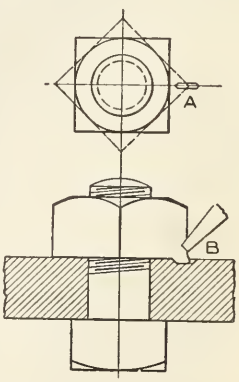
When using the pin as shown in the accompanying sketch, it is not necessary to have a set of extra pins on hand in case the cutter has to be ground, which makes it smaller. The nut A fits in the slot and carries the pin B, which screws into it with the end up against the top of the slot, then locking it in place. The two set screws are for adjusting the nut lengthwise of the slot. If a cutter is ground, making it somewhat smaller, the distance between it and the guide pin can be adjusted so that it will cut the same profile as before grinding. This device is an improvement as one adjustable pin serves the purpose of a set of solid ones. The pin is used for duplicating irregular shaped models on a profiling machine. —Contributed by G. E. Quinn, Hartford, Conn.



Two Views of the Guide

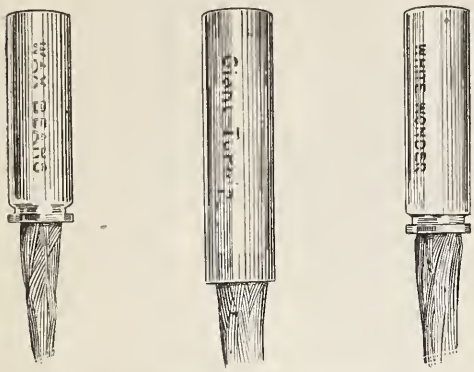
A Simple Nut Lock

There are a great many devices for locking nuts, but the one shown in the accompanying sketch is about as simple and effective as any of them. Screw the nut up to the desired tightness and mark the position of one of the corners, then loosen it a little and make a slot in the metal with a sharp chisel as shown at A. Tighten the nut again, then force the corner of the nut down into this slot by striking it with a punch, held as shown at B. This will hold the nut securely in its place.—Contributed by W. Parker, Olaf, Iowa.



Permanent Shrubbery and Vegetable Garden Labels

In endeavoring to secure a permanent label which would be at the same



Names on Paper Covered with Bottles

time cheaply and easily prepared, the following plan was hit upon. First secure a sufficient number of small bottles with corks, says House and Garden. The small tubes that prepared photographic developers come in will do, or one or two drachm homeopathic vials may be secured at your local drug store. Wire and some small stakes with one end trimmed down to fit the necks of the bottles, complete the equipment. Copper binding wire is best as it is very pliable and does not corrode when exposed to the weather.

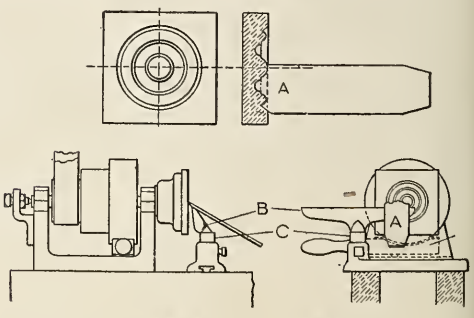
For the seed bed, clip from the end of the seed package the strip bearing the name of the variety planted, slip this into the bottle, cork tightly and wire to a stake at the end of the row. Or if desired, the bottle may be slipped over the end of the stake as shown in the sketch.

Tool for Turning Corner Blocks

The smaller wood-turning mills often receive rush orders for from 200 to 300 corner blocks of a special design, for interior finishing, to be turned up by hand. It would not be profitable to order this amount in a machine-made block. If these blocks are turned by hand with chisels it is very slow work and the profits are small. The accompanying sketch shows an improved chisel or cutter by the use of which the work can be turned out quite rapidly. This cutter is made out of a plane bit and has the cutting edge ground to suit the design of the block.

Carefully turn up a sample block, then saw it in half and grind the cutter to fit the outline of the block as shown in the upper sketch. A cutter should be made for each design of block. These cutters should be about ¼ in. wider than the cut desired so they will overlap on each side. The bevel should be slightly longer than that on a plane bit and in grinding it be careful not to burn the edge, or the temper will be drawn. Finish the edge with a slip-stone. If carefully made and of good material, this cutter will turn up from 500 to 600 blocks without regrinding, and will require only occasional sharpening with the slip-stone.

The manner of using this cutter is of as much importance as its making. If it is forced straight into the work it will chip the bead and tear the corners of the block. The proper way to use it is to set the steady rest, B, slightly below the center line so that the cutter will lay at an angle of about 30 deg. from the horizontal. Place the left hand on top of the cutter and hold it firmly on the rest, grasp the rear end with the right hand and make a light cut straight in; then move the rear end of the cutter back and forth, using the cutting edge as a fulcrum,



Turning Corner Blocks

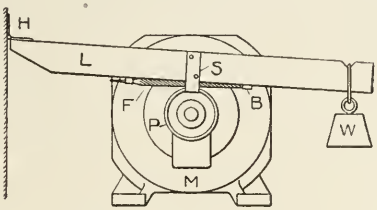
and at the same time forcing it into the work. This method will cause the tool to shave out the wood instead of knock-

ing it out in chips. On soft wood no sandpapering will be required if the tool is sharp.

The center-rest should have a collar, C, of the right height between its shoulders so that it can be swung clear when removing the blocks without resetting. The headstock bearings should be as tight as they will run without heating and there must be no end play, otherwise the cutter is liable to dig into the work. A simple brake can be made of a piece of hard wood, cut to fit the largest pulley on the headstock, and covered with a piece of belt leather. By using this brake the lathe can be stopped quickly, thereby saving much time in taking off and putting on blocks. The lathe should run at about 2600 or 2700 R. P. M., which is the fastest speed of most lathes. About 600 blocks a day can be cut with this tool which brings the cost down to a figure that compares favorably with machine-made blocks.—Contributed by J. H. Wyatt, Philadelphia, Pa.

How to Groove a Motor Pulley

As I wished to make a grooved pulley out of the flat-faced one on my motor, I rigged up the device shown

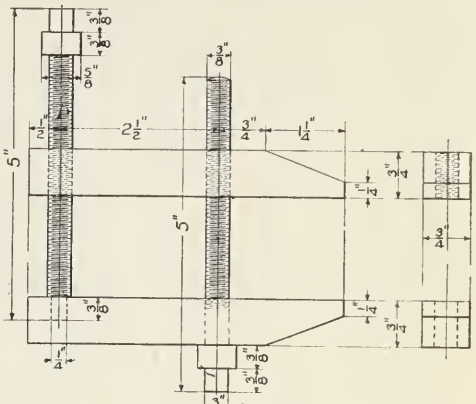


Cutting a Pulley Groove

in the accompanying sketch to do the work. The lever, L, is a piece of wood as wide as the pulley face. One end is hinged to the wall at H, and the other is notched for attaching the weight W. Under this lever I fastened a rat-tail file, F, by means of the bands B. The straps S keep the lever in position on the pulley face P, and as it turns the file cuts a round groove in it, which can be made as deep as desired.—Contributed by H. Hahn, Chicago.

A Machinist's Clamp

A cheap, handy and durable steel clamp for small work in the machine shop or about the home, that can be

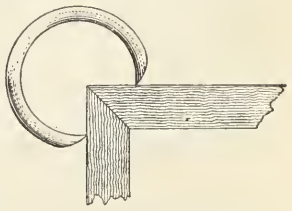


Clamp of Steel

made by the ambitious machinist is shown in the accompanying drawing. Secure a piece of cast steel of suitable size and cut off two lengths, each 5 in. long, plane them to ¾-in. square, and finish as per drawing. The screws are made of ⅝-in. cold rolled steel, and can be turned up in the lathe. The outer ends of the screws being ⅜-in. square the clamp can be operated by a ⅜-in. S-wrench.—Contributed by R. E. White, Schenectady, New York.

Clamp for Holding Mitered Corners

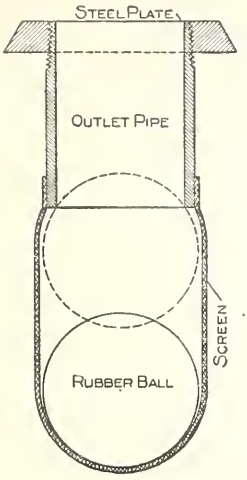
Secure enough $\frac{3}{16}$ or ¼-in. round tempered spring steel wire and make four rings 4½ or 5 in. in diameter. After the rings are formed the ends can be filed to a point on the inner surface.



They will be found very convenient in holding the corners of a frame while fitting the miters.—Contributed by D. O. Wilkins, Hempstead, Texas.

A Check Valve for a Drain

Secure a steel plate of suitable size and bevel the edge as shown in the accompanying sketch. This bevel is to hold the plate securely in the concrete floor when it is in place. A hole the size of the drain pipe should be tapped in the plate and a short piece of pipe screwed in it. Make a cage of copper wire large enough to hold a hollow rubber ball, which is somewhat larger than the opening in the pipe. The cage should be long enough to allow the ball to have a vertical movement of 2 or 3 in. and is soldered to the end of the pipe. Water will readily flow out of the drain, but if it backs up, the hollow ball will rise and stop the opening. This simple device is very handy where a heavy rain is liable to cause the water to back up in the drain. —Contributed by V. Metzech, Chicago.



A Never-Slip Nail Punch

This punch has the appearance of the ordinary kind, the only difference being the small diamond point in the center of the flat punch end. The point will hold the punch on the nail head when a blow is struck.

I once struck a punch a hard blow and the end slipped on the nail head

Diamond Point End

and the punch went through a window. I was "out" and so was the punch. I then proceeded to make a diamond point on my punch as described and I had no further trouble.—Contributed by C. Purdy, Ghent, O.

How to Clean and Care for Spark Plugs

Much of the trouble with spark plugs becoming dirty can be avoided to a large extent by not speeding or racing the engine while idle. The high speed causes the oil in the crank case to be splashed up on the walls of cylinders and into the plugs. This oil is then carbonized by the heat of the explosions, causing short circuits in the plugs. The electric discharge instead of taking place between the points of the plug, creeps across the carbon deposit, which kills the life of the spark, thus causing the cylinder to miss fire.

Much of the carbon deposit in cylinders can be avoided by giving the inside of the cylinders a bath of kerosene oil frequently. This should be done while the engine is warm, immediately after returning from a trip. Remove the plugs and squirt 1/3 qt. of kerosene into each cylinder, taking pains to squirt the oil around on the walls as much as possible. Replace the plugs and let stand several hours. Then start the engine to burn out the oil, and carbon that has been loosened. A dense smoke will issue from the muffler exhaust until all the kerosene is burned. Clean the plugs and the engine will run without a miss if the other parts are mechanically right.

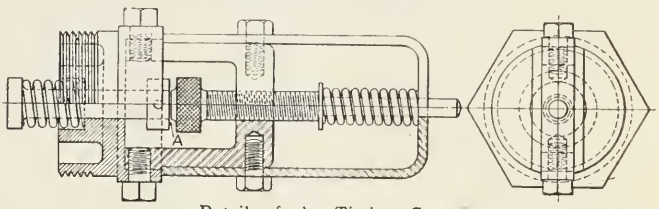
Some spark plugs are designed to be taken apart for cleaning, while others are not made to take apart, but instead are self-cleaning to a certain degree. In cleaning plugs that can be taken apart, first remove the porcelain core and brush off the carbon deposit with a tooth brush dipped in gasoline or ammonia, then scrape off all the carbon from the rest of the plug, brighten the spark points, and reassemble. Plugs that cannot be taken apart easily should be brushed out well with ammonia and the points brightened.

Most people are at a loss to know how to set spark plug points so as to get the best and most even explosions in all cylinders. After cleaning the plug parts thoroughly, screw them together. Then if you can slip a new silver dime between the points, the

distance is correct. Otherwise make the distance between the points to equal the thickness of a dime.—Contributed by C. E. F.

Valve Timing Gauge

A new design of a gas engine valve timing gauge that will prove useful to automobile repairmen is shown in the accompanying sketch. With this device the valves can be timed more accurately and with less trouble than by the old screwdriver method. The construction of the gauge is fully shown in the detail sketch. In use it is screwed into the valve plug hole in the cylinder with the lower plunger resting on the valve. Adjust the top plunger so that a thin sheet of tissue paper will just slip in between the ends of the plungers at A. Now turn the flywheel slowly and as soon as the paper is gripped by the plunger you will know that the valve is just starting to open. By turning the flywheel in the same direction until the paper is released the closing point of the valve can be determined. As the paper in question is but .001 in. thick great accuracy can be obtained with this gauge.—Contributed by C. T. Schaefer, St. Louis, Mo.



Detail of the Timing Gauge

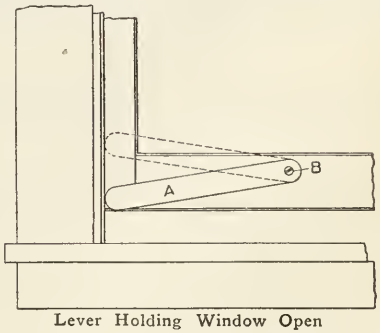
A Door Holder

Stable and woodhouse doors are very annoying when the wind blows them shut at a time they are wanted open. This may be remedied by opening the door entirely back against the side of the building and driving a nail through the door at the top and into the weather board. Pull the nail out of the board, but leave it sticking through the door. When the door is pushed back, the point of the nail sticks into the hole in the board, thus holding the door against the wind.—Contributed by Pleasant W. Dennison, Hope, Ind.

A Home-Made Window Fastener

There still remain in use many windows which are not equipped with either weights or springs, and when one wants to raise one of these a stick of just the right length never seems to be available, says a correspondent of the American Thresherman.

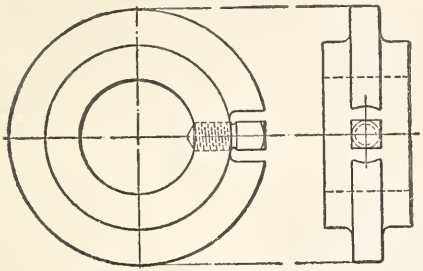
A handy and effective home-made device, which not only serves to hold the sash up at any desired point, but which will also hold it down, is shown in the accompanying sketch. It consists simply of a strip of hard wood, A, secured to the bottom sash rail by the wood screw, B, on which it swings freely. The strip, A, should be 1½ in. wide, ½ in. thick, and anywhere from 6 to 12 in. long. The screw should be at such distance from the side of the sash that, when the other end of the strip touches the window jamb, it will stand at about the angle shown. In this position it will serve to hold the sash up, and, when desired, will hold it in the opposite direction by swinging to the position shown by the dotted lines. Care should be taken to get the screw in the right place and fastened to the work solidly, as the successful operation of the device depends upon having the screw of good size and properly put in.



Lever Holding Window Open

Safety Collar

Many bad accidents are caused by the heads of setscrews in collars catching in workmen's clothing. These could be avoided if collars of the design



Setscrew Cannot Catch Clothes

shown in the accompanying sketch were used in dangerous and exposed places about machinery. A supplementary flange or collar is cast on to the ordinary collar, which has an opening for a setscrew. The collar presents a neat appearance on a shaft, is perfectly safe and also inexpensive.—Contributed by D. A. Hampson, Middletown, N. Y.

A Substitute Stop Cock

An inexpensive stop cock is often desired on steam or water pipes to serve as an air or exhaust valve. Where

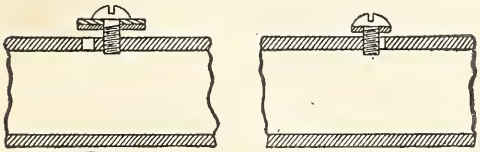


FIG. 1 FIG. 2

Two Kinds of Air Vents

there is no petcock handy, a good substitute can be made as follows: Drill a ⅛-in. hole through the side of the pipe in a convenient place. About ¼ in. from this hole, drill and tap another hole of the same size. Secure a brass machine screw to fit the threads and solder close to the head a brass washer ⅝ in. in diameter. Next to this place a rubber washer of the same size. By tightening or loosening the screw the valve is closed or opened, as shown in Fig. 1. Another method along the same line is shown in Fig. 2. This necessitates the drilling of only one hole, which, after being tapped, is filed away in a notch as shown. No washer is required when using this plan.—Contributed by C. W. Nieman, New York City.

A Screwdriver for Headless Setscrews

In a large textile machinery plant where there are thousands of headless setscrews used they have a screwdriver like the one shown in the accompanying sketch, says a correspondent of American Machinist. Anyone who has ever had a quantity of screws to put in will appreciate the fact that with this screwdriver it is not necessary to hold the fingers at the end of the screwdriver to prevent it from slipping out of the slot. It

Hold a Screw While Turning

also sets each screw to a determined depth, according to the location of the pin. About twenty ¼ by ¾-in. screws can be run in flush with the casting in one minute with this device.

Correct Air Pressure for Automobile Tires

For the purpose of informing car owners as to the proper pressure to be used in the inflation of tires in proportion to the weight carried, a manufacturer of rubber tires has compiled the following table. The weights are for cars unloaded. For weights exceeding 1,000 lb. per wheel, 5-in. tires and over are recommended.

Size. Inches.	Wt. per Wheel. Pounds	Air Pressure Recommended Pounds
28 to 36x2½	225	40
28 to 36x3	350	50
28x3½	400	60
30x3½	450	60
32x3½	550	60
34 and 36x3½	600	60
30x4	550	75
32x4	650	75
34x4	700	75
36x4	750	75
32x4½	700	85
34x4½	900	85
36x4½	1000	85
36x5		90

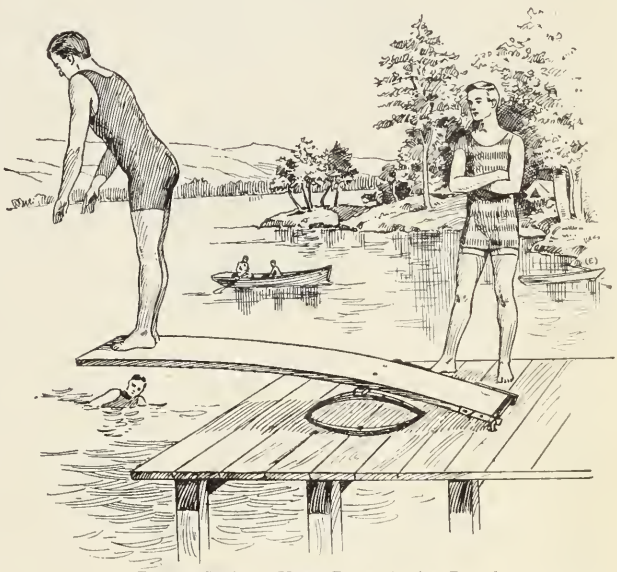
AMATEUR MECHANICS

Spring Board for Swimmers

A good spring board adds much to the fun of swimming. The boards are generally made so that the plank will bend, being dressed down thin at one end and fastened. The thinness of the plank or an insecure fastening causes many a plank to snap in two or come loose from its fastenings in a short time.

The accompanying sketch shows the method of construction of a spring board that does not depend upon the bending of the wood for its spring. It is made of a plank 2 in. thick and from 14 to 16 ft. long, one end of which is secured with a hinge arrangement having a U-shaped rod whose ends are held with nuts. On each edge of the board at the lower end are fastened two pieces of strap iron each about 1 ft. long with the lower ends drilled to fit the horizontal of the U-shaped rod.

Secure a pair of light buggy springs from a discarded rig and attach them to the ends of a square bar of iron having a length equal to the width of the plank. Fasten this to the plank with bolts as shown in the sketch. Should the springs be too high they can be moved forward.—Contributed by John Blake, Franklin, Mass.



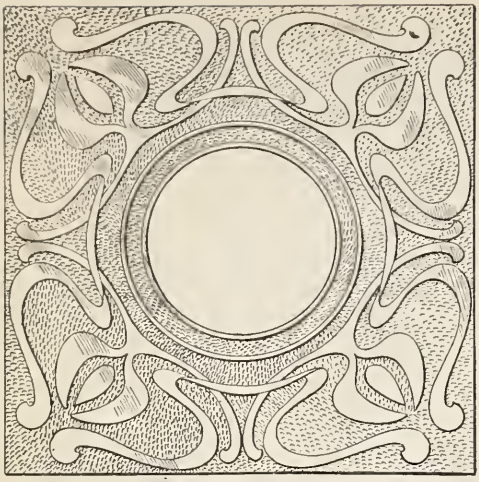
Buggy Springs Used Beneath the Board

Brass Frame in Repousse

Repousse is the forming of raised designs on metal by hammers and punches, the design being worked up from the reverse side. There is nothing especially hard in working up the design of the frame shown.

Punches can be purchased, as can the pitch bed or block. Both can be made easily, however. There will need to be several punches of different sizes and shapes. A piece of mild steel about ⅜ in. square can be easily worked into tools shaped as desired. A cold chisel will be needed to cut the metal to length, a file to reduce the ends to shape, and a piece of emery paper to smooth and polish the end of the tool so that it will not scar the metal.

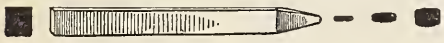
A small metal box must be secured to hold the pitch. The illustration shows an iron receptacle. The pitch is prepared by heating the following materials in these proportions: pitch, 5 lb.; plaster of Paris, 5 lb.; tallow, ½

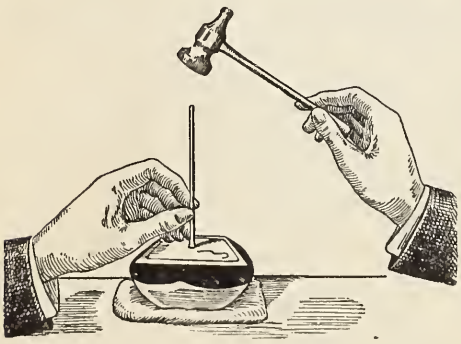


Design for the Frame

lb. To put it in another way, use pitch and plaster in equal parts with 1/10 part tallow. See that the pitch and plaster are dry so that the moisture will not cause the pitch to boil over. Keep stirring the mass so that it never boils. Melt the pitch first and add the plaster by degrees.

For a piece of repousse such as the frame shown, secure a piece of brass of about No. 18 gauge. With carbon paper trace the design on the brass. Place the metal on the pitch bed and work over the outline of the design. Use the chisel-edged tool and try to





Working Out the Design

make the lines continuous. When this has been done, heat the pitch slightly and place the metal, design down, on the pitch, and with the raising punches work up the shape as desired after the pitch has hardened. When the desired form has been obtained, turn the metal over and "touch up" any places improperly raised. The metal will probably be warped somewhat. To remedy this, place a board on the metal and pound until the metal assumes a flat shape again. Next drill a hole in the center waste and saw out for the opening, using a small metal saw. Trim up the edges and file them smooth.

Clean the metal thoroughly, using powdered pumice with lye. Cotton batting fastened to the end of a stick will make a good brush. Upon the cleansed metal put a lacquer to prevent tarnishing. Metal clips may be soldered to the back to hold the picture in place and also a metal strip to hold the frame upright. These should be placed before the metal is lacquered.

Finding the Horsepower of Small Motors

A small motor often excites curiosity as to its true horsepower, or fraction of a horsepower. Guesses in this direction vary remarkably for the same motor or engine. It is comparatively easy to determine the horsepower put out by almost any machine by the following method which is intended for small battery motors and small steam engines.

Before giving the description, it may be well to know what horsepower means. Horsepower is the rate of work and a unit is equal to 33,000 ft. lb. per minute, or 550 ft. lb. per second. That is lifting 33,000 lb. 1 ft. in one minute or 550 lb. 1 ft. in one second. This may be applied to the problem of finding the horsepower of a motor by fastening a piece of twine about 25 ft. long to the shaft of the engine or motor to be tested in such a way that when the shaft revolves it will wind up the string similar to a windlass. Place the motor in such a position that the twine will hang freely without touching anything; out of a high win-

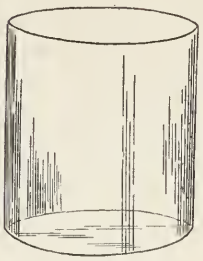
dow will do. Fasten a weight to the other end of the line as heavy as the motor or engine can lift and still run. It must weigh enough to slow the power down a little, but not to stop it. Mark the position of the weight and start the motor, at the same time accurately measuring time in minutes and seconds it takes to lift the weight from the lowest point to the highest. Next measure accurately the distance in feet covered by the weight in its ascent and obtain the correct weight in pounds of the weight.

Multiply the weight by the distance covered and divide the result by the number of minutes or fraction of a minute obtained and divide this last result by 33,000 and the quotient will be the horsepower of the motor or engine.

Perhaps an illustration will make this solution much plainer. Suppose the motor will lift a weight of 1 lb. and still revolve, 30 ft. in 10 seconds or 1/6 of a minute. Multiplying 1 by 30 we get 30, which divided by 1/6 gives 180. This in turn divided by 33,000 equals in round numbers 1/200 part of a horsepower.—Contributed by Harold H. Cutter.

Illusion for Window Attraction

Gold fish and canary birds, living together in what seems like one receptacle, make an unusual show window attraction. Secure two glass vessels having straight sides of the same height, one 18 in. in diameter (Fig. 1) and the other 12 in. in diameter (Fig. 2). The smaller is placed within the larger, the bottoms being covered with moss and aquarium decorations which can be purchased at a bird store. Fill the 3-in. space between the vessels with water. Cut a piece of galvanized screen into circular form to cover the larger vessel, and hang a bird swing, A, Fig. 3, in the center. Place the screen on top of the vessels so that the swing will hang in the center of the inner vessel. A weight—a box filled with sand will do—should be placed on top of the screen, over the smaller vessel, to keep it from floating. Moss should be put over the top of the screen so that the two separate vessels can not be seen.



18 in. Diameter
Fig. 1

12 in Diameter
Fig 2

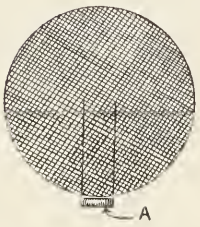


Fig 3

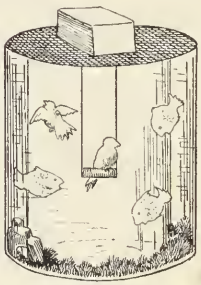


Fig. 4

Birds and Fish Apparently Together

Place the birds in the inner vessel and the fish in the water. The effect is surprising. To complete the effect and aid the illusion the vessels can be set in a box lined with black velvet, or on a pedestal.—Contributed by J. F. Campbell, Somerville, Mass.

Cleaner for White Shoes

Finely ground whiting mixed with water to the consistency of paste makes a very good coating for white shoes. A brush can be used in applying the mixture which will dry in a few minutes. It is best to mix only as much paste as required for immediate use.—Contributed by L. Szerlip, Brooklyn, N. Y.

¶Belt laces should never cross on the side next to the pulley as they will cut themselves in two.

An Outdoor Gymnasium

Part I—The Horizontal Bar

Gymnastic apparatus costs money and needs to be housed, because it will not stand the weather. Gymnasiums are not always available for the average boy who likes exercise and who would like to learn the tricks on horizontal and parallel bars, horse and rings, which all young athletes are taught in regular gymnastic courses.

Any small crowd of boys—even two—having a few simple tools, a will to use them and the small amount of money required to buy the necessary wood, bolts and rope, can make a first-class gymnasium. If trees are convenient, and some one can swing an axe, the money outlay will be almost nothing. The following plans are for material purchased from a mill squared and cut to length. To substitute small, straight trees for the squared timbers requires but little changes in the plans.

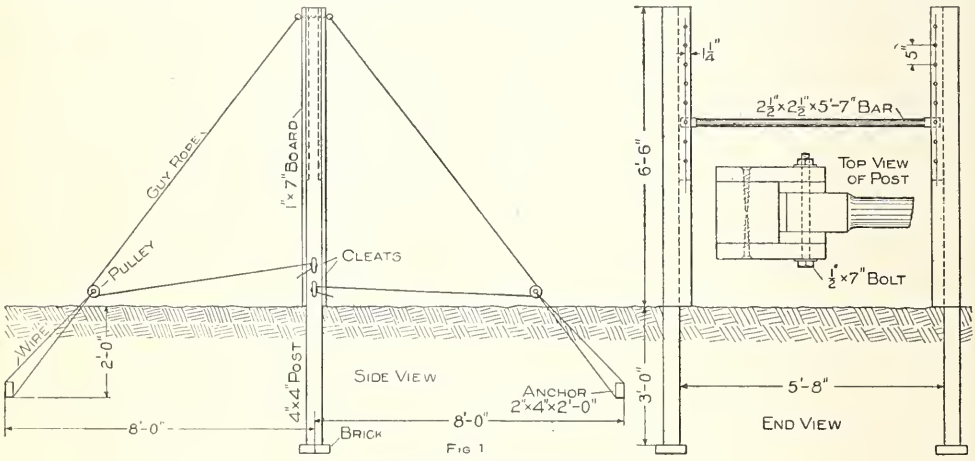


FIG 1
Adjustable Horizontal Bar

The most important piece of apparatus in the gymnasium is the horizontal bar. Most gymnasiums have two: one adjustable bar for various exercises and a high bar for gymnastic work. The outdoor gymnasium combines the two. The material required is as follows: 2 pieces of wood, 4 in. square by 9½ ft. long; 4 pieces, 2 by 4 in. by 2 ft. long; 4 pieces, 1 by 7 in. by 6½ ft. long; 4 filler pieces, ¾ by 3 in. by 3 ft. 9 in. long and 1 piece, 2½ in. square by 5 ft. 7 in. long. This latter piece is for the bar and should be of well seasoned, straight-grained hickory. It makes no difference what kind of wood is used for the other pieces, but it is best to use cedar for the heavy pieces that are set in the ground as it will take years for this wood to rot. Ordinary yellow pine will do very well. The four 7-in. boards should be of some hard wood if possible such as oak, hickory, maple, chestnut or ash. The other material necessary consists of 2 bolts, ½ in. in diameter and 7 in. long; 16 screws, 3 in. long; 4 heavy screw eyes with two ½-in. shanks; 50 ft. of heavy galvanized wire: 80 ft. of ¼-in. manila rope and 4 pulley blocks. Four cleats are also required but these can be made of wood at home.

Draw a line on the four 7-in. boards along the side of each from end to end, 1¼ in. from one edge. Beginning at one end of each board make pencil dots on this line 5 in. apart for a distance of 3 ft. 4 in. Bore holes through the boards on these marks with a $\frac{9}{16}$-in. bit. Fasten two of these boards on each post with the 3-in. screws, as shown in the top view of the post Fig. 1, form-

ing a channel of the edges in which the holes were bored. Two of the filler pieces are fastened in each channel as shown, so as to make the space fit the squared end of the bar snugly. The ends of the boards with the holes should be flush with the top of the post. This will make each pair of holes in the 7-in. boards coincide, so the ½-in. bolt can be put through them and the squared end of the bar.

Select a level place where the apparatus is to be placed and dig two holes 6 ft. apart, each 3 ft. deep and remove all loose dirt. The ends of the posts not covered with the boards are set in these holes on bricks or small stones. The channels formed by the boards must be set facing each other with the inner surfaces of the posts parallel and 5 ft. 8 in. apart. The holes around the posts are filled with earth and well tamped.

The hickory piece which is to form the bar should be planed, scraped and sandpapered until it is perfectly smooth and round except for 3 in. at each end. Bore a $\frac{9}{16}$-in. hole through each square end 1¼ in. from the end. The bar may be fastened at any desired height by slipping the ½-in. bolts through the holes bored in both the bar and channel.

Each post must be well braced to keep it rigid while a person is swinging on the bar. Four anchors are placed in the ground at the corners of an imaginary rectangle 9 by 16 ft., in the center of which the posts stand as shown in Fig. 2. Each anchor is made of one 2-ft. piece of wood, around the center of which four strands of the heavy galvanized wire are twisted, then buried to a depth of 2 ft., the extending ends of the wires coming up to the surface at an angle.

The heavy screw eyes are turned into the posts at the top and lengths of ropes tied to each. These ropes or guys pass through the pulley blocks, which are fastened to the projecting ends of the anchor wire, and return to the posts where they are tied to cleats. Do not tighten the guy ropes without the bar in place, as to do so will strain the posts in the ground. Do not change the elevation of the bar without slacking up on the ropes. It takes but little pull on the guy ropes to make them taut, and once tightened the bar will be rigid.

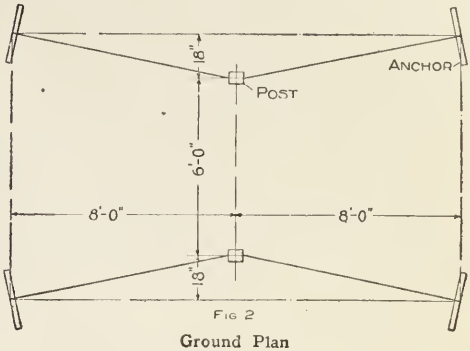


FIG 2
Ground Plan

Oil the bar when it is finished and remove it during the winter. It is well to oil the wood occasionally during the summer and reverse the bar at times to prevent its becoming curved. The wood parts should be well painted to protect them from the weather.

Electrostatic Illumination

Any one having the use of a static machine can perform the following experiment which gives a striking result. A common tumbler is mounted on a revolving platform and a narrow strip of tinfoil is fastened with shellac varnish to the surface of the glass as follows: Starting beneath the foot of the glass from a point immediately below the stem, it is taken to the edge of the foot; it follows the edge for about 1 in. and then passes in a curve across the base, and ascends the stem; then it passes

around the bowl in a sinuous course to the rim, which it follows for about one-third of its circumference; after which it descends on the inside and terminates at the bottom. The tinfoil on the outside of the glass is divided by cutting with a knife every ⅛ in., the parts inside and beneath the glass being left undivided. Current is then led from a static machine to two terminals, one terminal being connected to one end of the tinfoil strip, and similarly the second terminal makes contact with the other end. As soon as the current is led into the apparatus, a spark is seen at each place where the knife has cut through the tinfoil. If the tumbler is rotated, the effect will be as shown in the illustration. A variety of small and peculiar effects can be obtained by making some of the gaps in the tinfoil larger than others, in which case larger sparks would be produced at these points. The experiment should be carried out in a darkened room, and under these circumstances when nothing is visible, not even the tumbler, the effect is very striking.

How to Make a Wireless Telegraph Set

Part II—The Spark Coil

By Arthur Moore

The spark coil is the principal piece of apparatus used in the transmitter of a wireless telegraph set and its detailed construction is given herewith. The coil described here can be used for ordinary laboratory work, lighting Geissler tubes, etc., in addition to its use in the wireless set. All spark coils might be thought of as composed of the following parts: iron wire core, primary winding, secondary winding, vibrator, condenser, and containing case. These various parts will be taken up in turn.

The core of a spark coil is one of the most important parts and it should be constructed of a large number of small soft iron wires. If a solid iron core is used the reversal of magnetism in the core does not take place as rapidly as the current is interrupted by the vibrator. That is, the solid iron core would not take on and lose its magnetic effect as rapidly as the vibrator worked, which would result in a weak current in the secondary. A core composed of a number of small iron wires is said to be laminated.

To build the core procure a sufficient quantity of No. 22 gauge soft iron wire to form a bundle 1 in. in diameter, and 10 in. long. All of these pieces should be cut to the same length and straightened before they are placed in the bundle. One easy way to form this core is to wind on a stick 1 in. in diameter at least six turns of good quality paper and glue the various turns, as they are rolled on, forming a tube. Fill this tube with the pieces of iron wire, then roll it between two boards which will cause the wires to bed themselves better, and you can add more pieces, making your core much more compact. Wrap this core with a good quality twine, such as is used by shoemakers, the various turns to be placed neatly together.

Outside of the twine wrap 15 or 20 layers of very porous tissue paper and boil the whole core in a hot bath of beeswax and paraffin for at least one hour. This completes the core and you can now wind upon it the primary winding. The primary winding is to consist of three layers of No. 16 gauge double cotton-covered magnet wire wound on the core to within 1 in. of each end. It might be well to place two or three turns of good quality paper between the various layers. A terminal at least 10 in. long should be left at each end for making connections to the coil. It might be well for you to place a piece of small rubber tubing over the terminals where they are led from the winding. The completed core and winding, as shown in Fig. 1, should be thoroughly boiled in bees-

wax and paraffin before starting on the secondary winding.

The secondary winding is to be placed outside of this primary winding but must be insulated from it by an insulating tube placed over the primary winding. You can construct such a tube by winding on a piece of wood, whose outside diameter is a little greater than the outside diameter of the primary winding, several layers of paper and afterwards boiling it in paraffin. This tube should be about 2 in. longer than the primary winding and the inside diameter should be a neat fit over it. The wall should be about $\frac{3}{16}$ in. in thickness. All the additional space between the primary winding and the tube should be filled with paraffin.

Too much care cannot be used in properly constructing and insulating the secondary winding. For very small coils it is customary to wind all of the secondary wire in one section while in larger coils the secondary winding is composed of a number of sections, if it is desired to reduce the possibility of breakdowns. When all of the wire is wound in one section the difference in electrical pressure between the various layers becomes enormous and the insulation must be greatly increased. If the secondary is made of a number of sections, as shown in Fig. 2, and they are so connected that their electromotive forces all act in the same direction, the same total electromotive force can be obtained from the coil, but the voltage between the various parts of the winding is not nearly so great as in the previous case.

The secondary of the coil described here is to consist of six double sections, and these six sections when placed side and side should take up a length of 6 in., that is, each section should be 1 in. in thickness. You will find the winding of these various sections of the secondary a very tedious job if attempted by hand and time will be gained by constructing a simple form of winding machine.

The core of the form upon which these coils are to be wound should have a diameter a little greater than the outside diameter of the insulating tube. The cross section of such a form is shown in Fig. 3. The disks D_1, D_2 and D_3 can be made of ½-in. wood and should be about 4 in. outside diameter. The two cores C_1 and C_2 should have a length of about ½ in. and the diameter of the two ends should differ by $\frac{1}{16}$ to

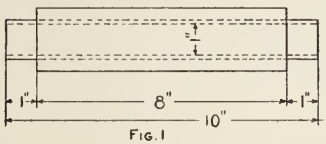


FIG. 1

FIG. 2

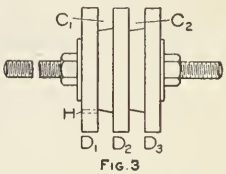


FIG. 3

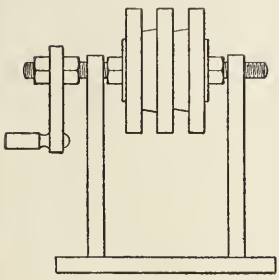


FIG. 4

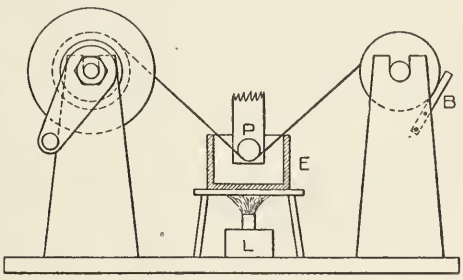


FIG. 5

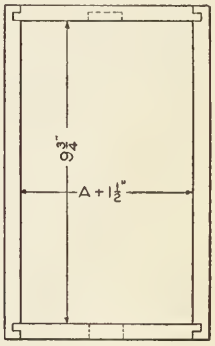


FIG. 6

Method of Winding the Coils

⅛ in. This form can be fastened in a lathe and the wire wound on in a very short time, but usually the amateur has no lathe that can be used and must devise some type of machine that will serve the same purpose. The form just described can be supported by two uprights as shown in Fig. 4 and it can be rotated by means of a small handle attached to one end of the shaft.

In winding the secondary, the wire should pass through a hot bath of beeswax and paraffin as it is being placed on the coil, instead of depending upon the boiling out process as in the case of the primary winding. This can be accomplished by the arrangement shown in Fig. 5. A small can, E, is supported above a gas or oil flame, L, and contains the beeswax and paraffin. The wire is made to pass through this mixture because it must pass over the small pulley P which is below the surface of the mixture. The tension in the wire can be adjusted by placing a small brake, B, on the spool from which the wire is being unwound. There will be needed for each double section about 5½ oz. of No. 34 gauge single silk-covered magnet wire. Make sure in winding that the operation is slow enough to allow the wire to become thoroughly saturated, but it must reach the coil before the wax has had time to cool. You can remove the coils from the form very easily if you line the form with sheets of paper before you start the winding. To wind one of the double sections proceed as follows: Pass 3 or 4 in. of the wire through the opening H in disk D_1, Fig. 3, and wind 2¾ oz. in the regular way upon the core C_1, terminating the winding on the right-hand side of the coil or next to the disk D_2. When this first coil is complete remove the form from the shaft and turn the coil around and place it back on the shaft. The disk D_2 will now be on the left-hand side of the coil and the inside end of the coil winding will project through the disk D_1 on the right-hand side. Carefully remove the disk D_2 and place four or five paper washers that have been saturated in paraffin against the side of the coil. Put the core C_2 in place with its small end to the left and the disk D_3 on the outside. Do not replace disk D_1. Solder the end of the wire to the inside end of the first coil. Tape this point thoroughly and do not use a flux that will destroy the wire. Two and three-fourths ounces of wire should now be wound on the second core and the winding terminated at the right-hand side or near the disk D_3. It no doubt would be best to boil this double section in hot paraffin before it is removed from the form. If this is done do not allow it to get too cool before the disks and cores are removed, as the coil may be damaged in trying to separate them. These various sections may be placed in linseed oil and allowed to soak, which will add to their insulation properties.

When all of the sections are complete they should be placed on the outside of the insulating tube and connected in series in such a way that if a current is passed through them it will flow around the core in the same direction in all of them. Seven or eight paper washers saturated with paraffin should be placed between each double section as they are placed on the insulating tube. This completes the most difficult part of the work and the next thing in order will be the construction of a suitable case for the coil.

The customary manner of constructing such a case is to make the base in such a form that it will contain the condenser, and the primary and secondary windings can be placed in a smaller case mounted upon this base. The binding-posts which serve as terminals for the primary and the vibrator are also mounted upon the top of the base.

Cut from some well-seasoned cherry or other close-grained wood two square pieces whose edge is ½ in. greater than the outside diameter of the completed secondary. Bore a 1-in. hole through the center of one of these pieces and a 1-in. hole half way through the center of the other. Figure 6 gives the dimensions of the sides and the means of fastening the ends and sides together. The bottom can be made of ⅜-in. ma-

terial held in a groove ⅜ in. wide and ¼ in. deep, cut around the inside of the frame just formed ¼ in. from the edge. This bottom must be put in place before the frame is fastened together. The coil will also have to be put in place before the frame is fastened together. The top can be made from ½-in. material and screwed to the top of the frame with round-headed brass screws. The corners can be rounded off and the box given a nice finish.

Wood-Working for Beginners

By Ira S. Griffith

CHAPTER V

Planes: How to Set and Adjust the Irons

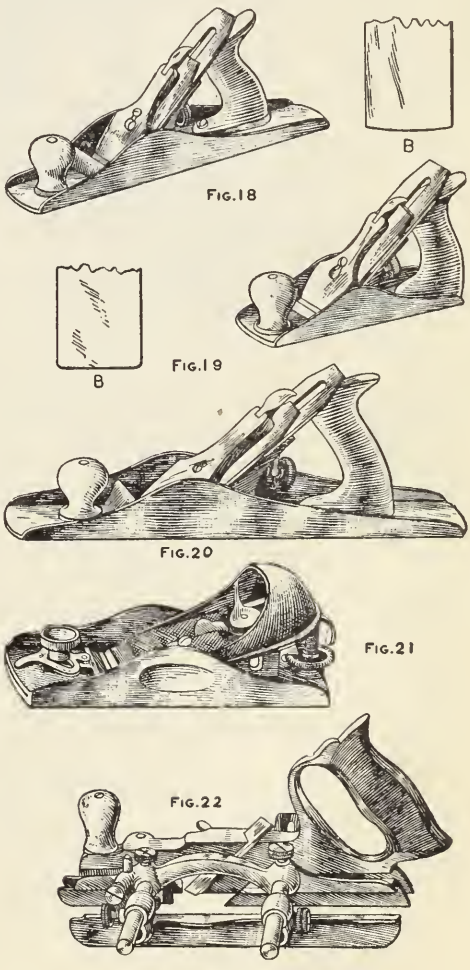
Among the various planes used by wood-workers are the following: block plane, smooth plane, jack plane, jointer and a special plane known as a combination plane. Not all of these planes are absolutely necessary for simple work such as a beginner would do, but they are desirable. The smooth plane, jack plane and jointer differ only in their length, width of cutter or plane iron and in the manner of shaping the cutting edge of the plane iron.

The jack plane, Fig. 18, is used for planing off rough surfaces or where it is desired to take off a large quantity of wood quickly. Since it is not expected to leave the surface smooth, this being done by means of another plane, the plane iron of the jack plane is ground rounding as shown in Fig. 18, B, this form of iron being better adapted for "roughing off."

The smooth plane, Fig. 19, is shorter than the jack plane. Since it is used merely, as its name implies, for smoothing off surfaces that have previously been straightened, or surfaces where straightening is not essential, the short length is an advantage rather than a disadvantage. Its plane iron is ground straight across with the corners very slightly rounded, Fig. 19, B.

For planing long edges straight the jointer, Fig. 20, is used. Because of its great length it makes edge planing much easier than when the shorter planes are used. On account of its length the high places must be cut off before the plane iron can touch the low places. Its iron is sharpened like that of the smooth plane—straight across.

The block plane, Fig. 21, is used for planing the ends of pieces of wood; for this reason no cap iron is necessary to break the shaving, there being none, only sawdust. It also differs from the other planes in that the bevel of the plane iron is turned up instead of down.



Different Kinds of Planes

The block plane's chief advantage over the other planes for end planing lies in its being small enough to be operated

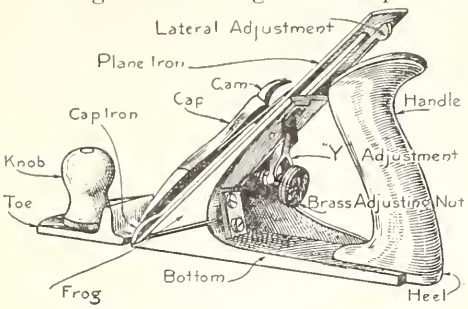


FIG. 23

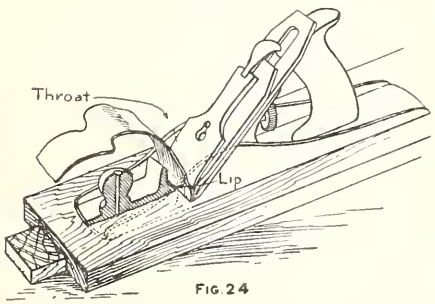


FIG. 24

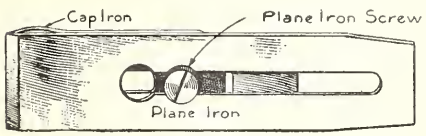


FIG. 25
Plane Parts

with one hand, leaving the other free to hold the board.

The combination plane, Fig. 22, is used in making grooves, rebates, etc. By an exchange of cutters it may be made to take the place of a great variety of special planes.

Figure 23 shows a section of a modern plane and gives the names of the more important parts. From this it will be seen that the principal parts consist of (1) the cap, (2) the cap iron which breaks and bends the shaving (Fig. 24) so that the wood may be torn up, (3) the plane iron for cutting the wood and (4) the frog to which these parts are fastened.

Figure 25 shows the relative positions of plane iron and cap iron. The cutting edge of the plane iron should extend about $\frac{1}{16}$ in. below the edge of the cap iron for ordinary work. For fine work the distance between the edges should be less. The cap iron and plane iron must be firmly fastened together, the cap being used to turn the stout screw unless a screwdriver is at hand, otherwise a few strokes will have pushed the iron back into the mouth of the plane.

After these parts are securely fastened together put them on the frog, plane iron down and cap iron up, making sure the plane iron rests flat on the frog with the Y-adjustment in the slot in the cap iron made for it. Next, place the cap in position and push down the cam. Should this cam work loosely and the plane iron and cap iron not be held firmly, adjust the cap screw. Ordinarily this screw when once adjusted needs no attention. Should the cam work too hard, make sure the plane iron is flat on the frog before releasing the cap screw.

To adjust the blade or plane iron, hold it as shown in Fig. 26, turning the plane toward the light. Sight along the bottom, turning the adjusting nut until the blade will project very slightly, not much more than the thickness of drawing paper. The most common error beginners make in learning to use the plane is setting the plane iron too far out of the mouth of the plane. Move the lateral adjusting lever to one

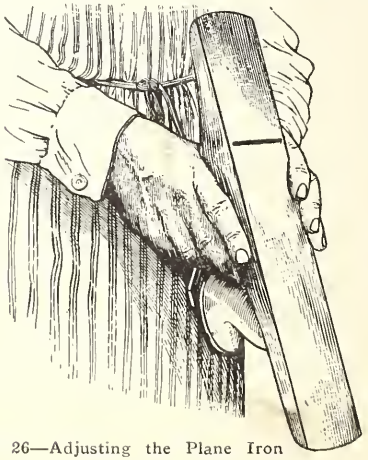
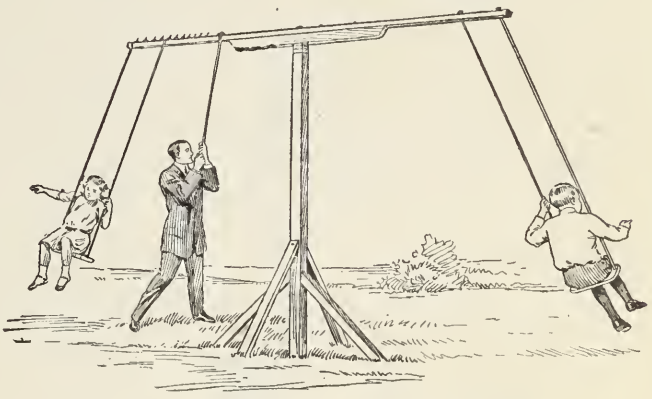


Fig. 26—Adjusting the Plane Iron

side or the other until the plane iron projects the same amount on each side.

A Merry-Go-Round Thriller

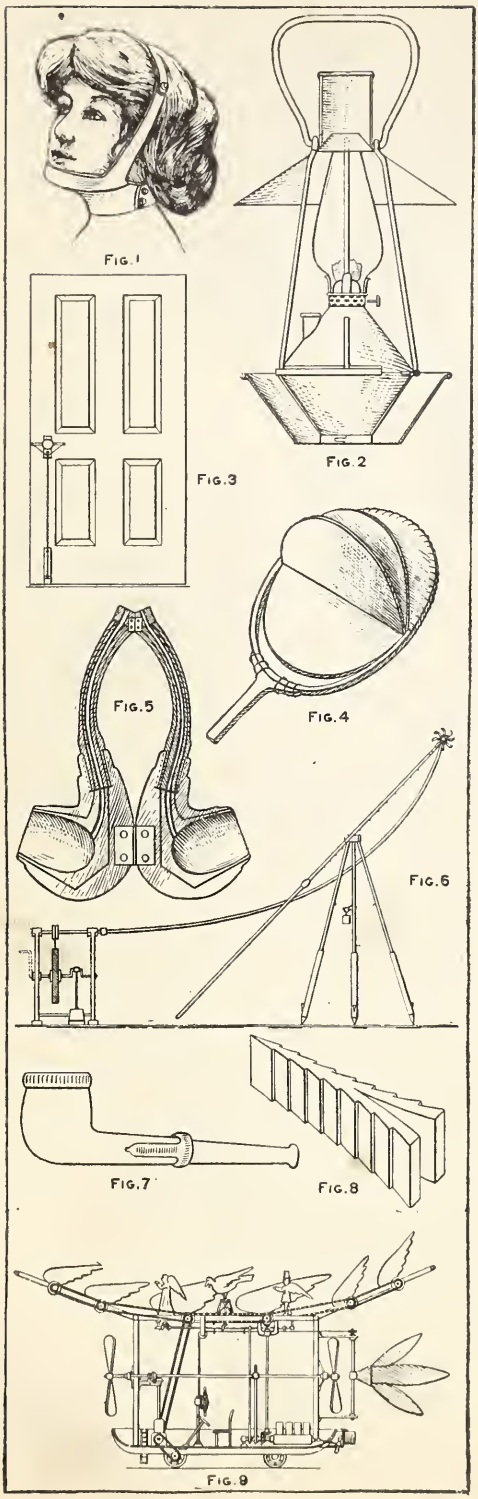
As a home mechanic with a fondness for amusing the children I have seen many descriptions of merry-go-rounds, but never one which required so little material, labor and time, and which gave such satisfactory results, as the one illustrated herewith. It was erected in our back yard one afternoon, the materials being furnished by an accommodating lumber pile, and a little junk, and it has provided unlimited pleasure for "joy-riders," little and big, from all over the neighborhood. It looks like a toy, but once seat yourself in it and begin to go around, and, no matter what your age or size may be, you will have in a minute enough thrill and excitement to last the balance of the day.



Swinging on the Merry-Go-Round

The illustration largely explains itself, but a few dimensions will be a help to anyone wishing to construct the apparatus. The upright is a 4 by 4-in. timber, set 3 ft. in the ground with 8 ft. extending above. It is braced on four sides with pieces 2 in. square and 2 ft. long, butting against short stakes. The upper end of the post is wound with a few rounds of wire or an iron strap to prevent splitting. The crosspiece is 2 in. square, 12 ft. long, strengthened by a piece 4 in. square and 5 ft. long. These two pieces must be securely bolted or spiked together. A malleable iron bolt, ¾ in. in diameter and 15 in. long is the pivot. On this depends the safety of the contrivance, so it must be strong enough, and long enough to keep firmly in the post. Drive this bolt in a ⅜-in. hole bored in the post, which will make it a sufficiently tight fit. Make the hole for the bolt very loose through the crosspiece, so that there will be plenty of "wobble," as this is one of the mirth-making features of the machine. Use a heavy washer at the head. The seats are regular swing boards, supported by a stout and serviceable rope. A ¾-in. rope is not too heavy. One set of ropes are passed through holes at the end of the crosspiece and knotted on top. The other set should be provided with loops at the top and slid over the crosspiece, being held in position by spikes as shown. This makes an easy adjustment. Seat the heavier of the riders on the latter seat, moving it toward the center until a balance with the lighter rider is reached. A rope tied to the crosspiece about 2 ft. from the center, for the "motive power" to grasp, completes the merry-go-round.

Put plenty of soap or grease between the crosspiece and upright. Be sure to have room for the ropes to swing out at high speed, with no trees or buildings in the way. The "wobble" mentioned will give an agreeable undulating motion, which adds greatly to the flying sensation. This will be found surprisingly evident for so small a machine. As there is no bracing, care must be taken to have the two riders sit at the same moment, or the iron bolt will be bent out of line. If it is to be used for adults, strong clear material only should be employed.—Contributed by C. W. Nieman.



INTERESTING PATENTS

CHIN MASK—This rubber chin-mask (Fig. 1) is presumably designed to take its place among the many devices for the preservation and beautifying of the face and head. It fastens over the head and around the neck, and is shaped to hold the lower jaw in proper position and press back any indication of double chin.

INSECT-DESTROYING LAMP—Figure 2 shows a lamp device for the destruction of insects that fly at night. Combined in the device are a base pan, a lamp, a shade and a cylindrical cage loosely disposed upon the shade. The cylindrical cage, which is shown directly above the chimney, has a screen covering its upper end. The insects, attracted by the light, fly under the lamp shade, and are caught in the cage and burned.

HANDLE-CONTROLLED DOOR STOP—The door attachment shown in Fig. 3 will hold a door in any position desired by simply releasing the handle. It consists of a rubber block and a spring, connected with the door handle by means of a wire. The turning of the door-knob elevates the block from the floor, and its release causes the block to again engage with it.

AN AIR-COOLING FAN—The ordinary fan cools the person using it by creating a draft of air, but this fan (Fig. 4) also cools the air. The body of the fan consists of three sheets, the inner one of which is composed of absorbent material. This is moistened with water and the textile sheets are fastened in position over it. The movement of the fan moistens the air, thus cooling it.

SANITARY TOBACCO PIPE—The difficulty of keeping the ordinary pipe clear of nicotine has resulted in the invention of the pipe shown in Fig. 5. In principle, it operates in the same manner as a pipe case, separating through the center and swinging open on hinges at the base of the bowl and near the end of the stem. When open, the bowl and passage leading up through the stem are completely exposed for cleaning. The draft channel is made air-tight by means of a rib on one section, and a groove on the other, in which the rib engages. The two sections are held tightly together by means of a ring on the bowl and on the stem.

ROTARY HEDGE-TRIMMING MACHINE—This apparatus (Fig. 6) is a rotary hedge-trimming machine, the knives of which are driven by a flexible shaft. The knives are stellated cutting blades mounted adjacent to one another, one of the blades being rotated by the flexible shaft. The shaft is driven by means of a hand-turned set of gears mounted on a standard, and the cutting blades are forced against the material to be cut by means of a pole, which is supported by a tripod standard.

MATCH-SCRATCHING ATTACHMENT FOR PIPES—A match-scratching device that may be affixed to the stem part of the bowl of a pipe is shown in Fig. 7. Barbs on the inner side of the scratching surface may be forced into the wood of the pipe to keep it in position. It is made still more secure by means of a clip that encircles the stem and hooks into an eye.

ATTACHING WEDGE—Figure 8 is a flat wedge of resilient material split longitudinally for a portion of its length, from its thick end towards its thin end, thus forming two resilient wings. The exterior faces of the wedge are formed with teeth inclined towards the butt end. A wooden shank, with a metallic socket, fits into the split portion of the wedge for driving it.

AN EXTRAORDINARY FLYING-MACHINE—The purpose to which the inventor expects to put this remarkable flying device (Fig. 9) is beyond conjecture, but that she (the inventor is a woman) has some serious end in view is probable from the fact that it has just been patented. If it were designed for a toy the patent specifications would probably have stated so, yet that is what it seems to be. The specifications say it is a flying-machine, consisting of the combination with a body, of a main and an auxiliary motor supported within the body, propelling means operatively connected to both motors, and movable wings supported above the body and operatively connected to the motors. Among the different propelling devices shown by the drawing are a screw propeller at the stern, arranged like that of a motorboat; two air propellers, one forward and the other at the rear; and a number of wings, a central bird, a figure of an angel, and a man with wings and a top hat.

PRACTICAL OR UNIQUE

ROPE-MAKING MACHINE—Figure 10 is a simple rope-making machine, consisting of three hooks with gearing for rotating them. The three hooks are not all in a direct line, the side hooks being projected in advance of the central hooks to form an accurate series for maintaining the three strands at uniform length.

COLLAPSIBLE STEEL HORSE—The steel horse shown by Fig. 11 has legs that can be folded up against the body out of the way. The construction is of angles and butts with stiff connection between legs and body. It is quite as light as the ordinary wooden horse, and is adapted to any of its uses.

TROUBLE-FINDING SPARK GAP—Ignition trouble is sometimes difficult to locate in an automobile engine because of the number of cylinders, any one of which may be the one making the trouble, but with this extra trouble-finding spark gap (Fig. 12), a 6-cylinder engine is said to become as simple as a single-cylinder engine. It is substituted for the terminal on each spark plug, and the terminal in turn is attached to the end of the trouble-finder. The spark gap, which duplicates the spark occurring within the combustion chamber, is covered with glass so that the operator can see exactly how the ignition is working.

SPRAY ATTACHMENT FOR DENTAL DRILLS—Figure 13 is a spray attachment to be used in combination with a drill in dental work, and its purpose is to keep the surface being drilled, or otherwise worked upon, free of the substance thrown off by the drill. It consists of a nozzle running parallel with the handle of the drill, and a bulb attachment held in the hand as shown by the drawing. The bulb is detachable.

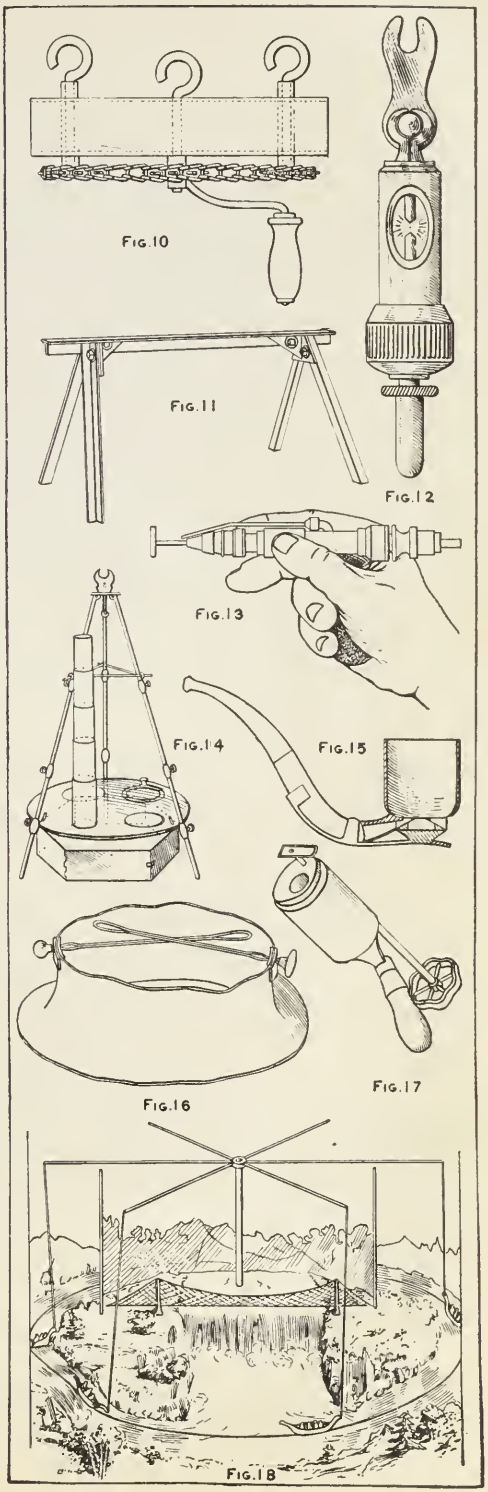
STOVE FOR CAMPS—The inventor of this device (Fig. 14) believes he has designed an ideal stove for camping. It consists of a collapsible metal casing to form the fire-box, a sectional top provided with a stove-pipe hole and three openings, and an adjustable tripod designed to hold the chimney in position and provide a crane for some kinds of cooking. The circular stove top is attached to the lowest joints of the tripod by means of hooks, so that there is a few inches of space intervening between it and the top of the fire-box.

MUSICAL PIPE—This pipe (Fig. 15) may be used either for smoking or for the making of musical notes, but not for both at the same time. The bowl has a contracted opening at the inner end, and a tubular stem secured to the inner end and terminating at one side of the opening, so arranged as to direct a current of air across the opening to produce a sound. The bowl is adapted to form an extension of the vocal cavity of the operator's mouth, whereby musical notes may be produced. In order to adapt the pipe for smoking, a plug pierced by a duct is provided to connect the duct of the stem with the smoking cavity of the bowl.

SAFETY-HATPIN—The hat-pins in this hat (Fig. 16) are of a safety variety just patented. The loops just back of the heads and at the ends of the pins are expanding. To use the pins, the crown of a hat must be provided with slotted plates, through which the pins are passed. The loops close together when pushed through the slots, then expand and lodge tightly in the hair.

CARBON REMOVER—Deposits of carbon on the inner surfaces of gasoline engines are usually removed by pouring kerosene into the chamber, but Fig. 17 shows a scraping device with which to accomplish the same result. It comprises a guide adapted to fit in an opening in the end of the engine cylinder, a stem passing through the guide and turning within it, and a scraper blade carried by the end of the stem. The scraper is moved over the surface to be cleaned of carbon by turning the stem.

AQUATIC MERRY-GO-ROUND—New devices are continually being designed for the amusement of the thousands of people who patronize amusement parks. One of the latest is this aquatic merry-go-round (Fig. 18). It consists of a circular waterway, guiding means for the boats that ride on the waterway, a sheet of falling water incorporated into the scenery inside the waterway, and means for feeding the water producing the falls from the stream on which the boats travel, this water finally emptying back into the stream.



HUG-CHUG!
Br-r-r! b-r-r-r.
Honk-honk!
Gilligillug-gilligillug!

The pedestrian paused at the intersection of two busy cross streets.

He looked about. An automobile was rushing at him from one direction, a motorcycle from another, an auto-truck was coming from behind and a taxi-cab was speedily approaching.

Zip-zip. Zing-glug!

He looked up and saw directly above him a runaway airship in rapid descent.

There was but one chance. He was standing upon a manhole cover. Quickly seizing it, he lifted the lid and jumped into the hole just in time to be run over by a subway train.—Cleveland Plain Dealer.

Teacher: "Johnny, can you tell me how iron was first discovered?"

Johnny: "Yes, sir."

"Well, just tell the class what your information is on that point."

"I heard father say yesterday that they smelt it."—Am. Artisan & Hdwe. Record.

With stealthy footsteps the burglars made their way into the business office of the merchant whose store they had just entered.

Flashing a dark-lantern around the room, they saw that the door of the safe was partly open.

On a small table near the safe lay several documents.

The burglars inspected them.

One was a bill for automobile repairs.

Another was an ice bill.

Both were receipted.

"Pete," said one of the two men in a hoarse whisper, "ther' hain't no use lookin' at the other dockyments. We're too late!"—International Railway Journal.

First plumber (glancing across the street)—"Your neighbor over the way doesn't look like a very active man."

Second plumber—"I should say he isn't active; why, a moving picture of him would be just an ordinary photograph."

He was such a superior super, and simulated the emotions of surprise, horror, contempt, and gentle interest so admirably while the "stars" were speaking that in the second production of the season they gave him four words to speak. They were very important words. In the very middle of the crisis in the third act he was to rush on the stage, and cry: "The queen has swooned!" The eventful night, the eventful hour, the eventful minute arrived, and the superior super, primed with and proud of his Lilliputian part, rushed frenziedly on to the stage. "The swoon has queened!" he roared excitedly. A roar of laughter shook the foundations of the theatre. But, with a wonderful effort, the superior super regained himself. "I mean," he shouted, "the sween has cooned!" Again the walls trembled. "Come off, you idiot!" muttered the stage-manager, in a hoarse whisper that could be heard all over the house. But the ambitious super refused to surrender, and, in a rasping voice, he screamed: "The coon has sweened!"

Alarmed Motorist (after collision)—"Are you hurt?"

Butcher's Boy—"Where's my kidneys?"—Punch.

It was a murky day in August, and the old sea captains were talking of a schooner which had been struck by lightning a few days before, and adding their contributions to nautical fiction, thinly disguised as fact. "How about the 'Emma S.,' Capt. Eli?" asked the privileged listener at last. "Wasn't she struck once?"

"She was sir," and Capt. Eli fixed his gaze on a crack in the ceiling of the old wharf office. "She was indeed off the cape; home'ard bound, she was."

"I'd like to hear the particulars," said the young man, and all the captains moved in their seats and fixed their eyes on the crack which held the gaze of Capt. Eli.

"'Tisn't much to tell, only what might happen to any vessel under similar circumstances," said Capt. Eli. "A bolt struck the deck amidships, and bored a hole right down through the bottom of the schooner big as a man's leg. The water come rushing in, and o' course the Emma S. would have foundered if a second bolt hadn't come and struck my forto 'galla 'mast, cut it off near the top, turned it end for end, and drove it right into the hole, plugging it up and making it water-tight.

"'Twas a clear case o 'what folks call the ravages an' repairs o' nature," said Capt. Eli, as he removed his gaze from the crack and let it rest thoughtfully on the ingenuous face of the only landsman in the company.—Marine Journal.

A young man took his seat in a restaurant. A waitress approached his table with a shuffling gait.

"Have you frog's legs?" he inquired.

"No, indeed! I have the rheumatiz."

"A food faddist was lecturing to a large audience on the marvellous results to be obtained from chewing soup, or eating nut butter, or something of that kind. He was not a very imposing person physically, but swelling out his chest, he slapped it thrice, with his palm and cried:

"'Friends, two years ago I was a walking skeleton, a haggard miserable wreck. Now, what do you suppose brought about this great change in me?'

"He paused to let his words sink in, and a voice asked:

"'What change?'"

Gilhooley: "You talk about working one's way up in this world—why, look at me, I now have a position where a hundred men work under me."

Willie: "My! You must be delivering the goods. What is your position?"

Gilhooley: "I'm repairing the roof of the back shop, and the other men work on the ground."
—Santa Fe Employes' Magazine.

Village Constable (to villager who has been knocked down by passing motorcyclist)—"You didn't see the number, but could you swear to the man?" Villager—"I did; but I don't think 'e 'eard me."—Punch.

"Life ain't nothin' but disappointment," groaned the Chronic Grouch.

"Cheer up!" urged the Cheerful Mutt. "Didn't you git $50 for puttin' yer picture in the paper as havin's ben cured o' all yer ills by Bunk's Pills?"

"Yes, I did. An' now all my relatifs are askin' me why I don't go to work, now th't I'm cured!"
—Cleveland Leader.

After a recent cut-over, when some of the lines were somewhat mixed, a prominent surgeon was called to the telephone to be met with the question, "Is this the butcher shop?" The reply was so hot it blew a fuse.—The Transmitter.

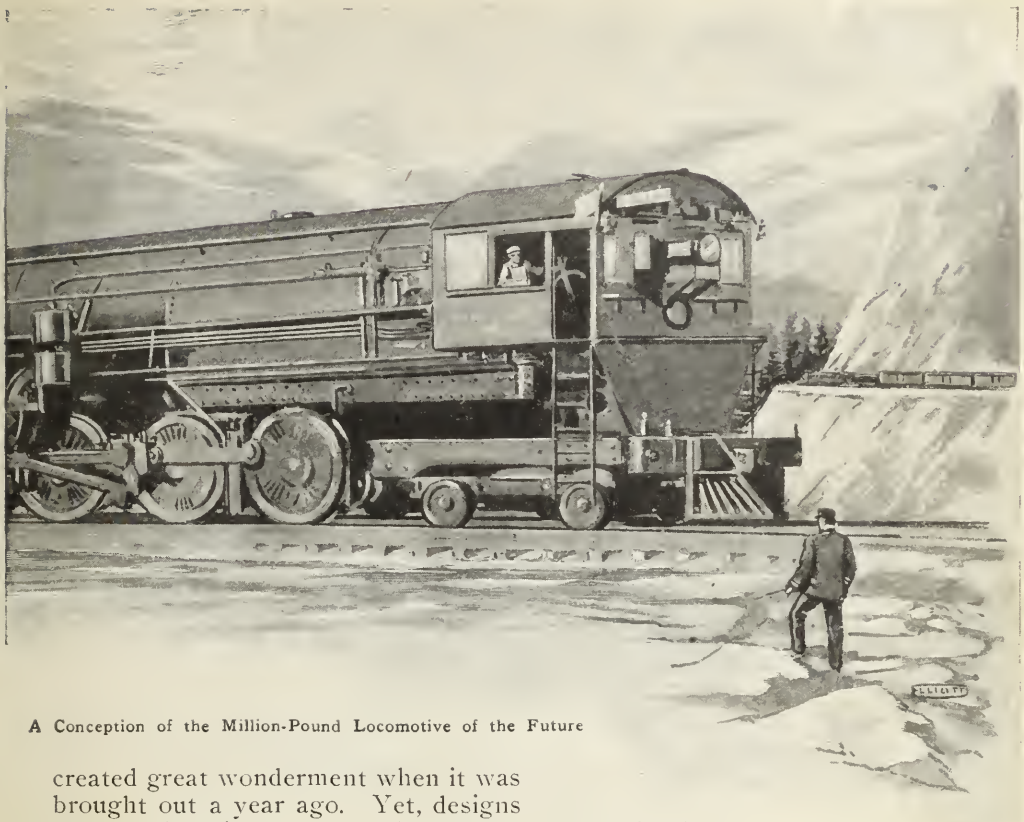
"Where is Marie?"

"Upstairs, sir. She is arranging madam's hair."

"And madam—is she with her?"—"Rions," Paris.

"So you think the automobile has made life much pleasanter?"

"It has for me," answered the comfortable citizen. "I drive a fast horse and my son rides a bicycle. The automobile has taken the minds of the police off both of us."—Washington Star.



A Conception of the Million-Pound Locomotive of the Future

created great wonderment when it was brought out a year ago. Yet, designs are already being drawn up by a western road for a locomotive that will exceed it in weight, and a few months ago there was delivered to the Delaware and Hudson Railroad one that exerts a pressure of 441,000 lb. on the driving wheels alone. The great Santa Fe engine exerts a pressure of 412,000 lb. on the driving wheels. And it is the weight on the driving wheels that counts. One of the features of the new Delaware and Hudson locomotive is the absence of the small trucks, and the placing of the entire weight on the driving wheels. The advisability of this innovation remains to be proven.

In railroading everything depends on many other things. A locomotive must be constructed in accordance with the capabilities of the roadbed and tracks to stand the enormous weight, the strength of bridges and culverts, the height of funnels, the overhead clearance of bridges, and a score of other considerations.

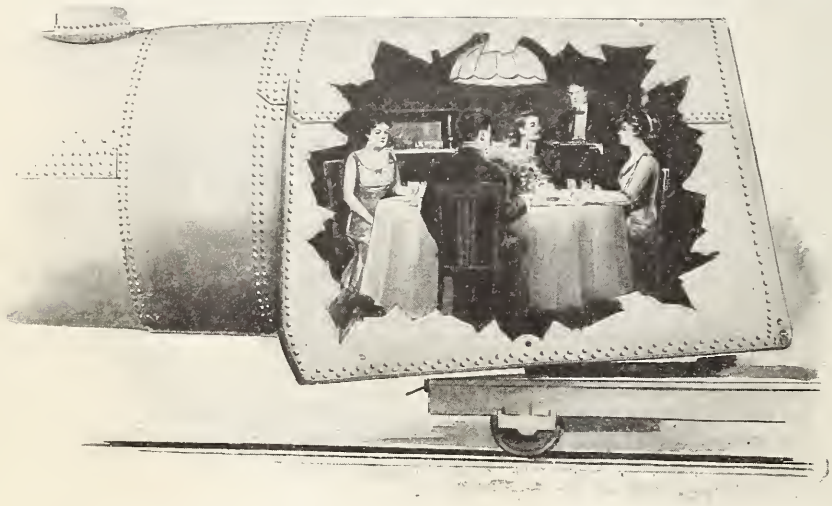
Despite the great advance made since Stephenson built his "Rocket", there are a great many characteristics of the locomotive to which the designers have adhered religiously. Some of these will undoubtedly have to be abandoned.

If the 500-ton giant is to have all the space possible for its boiler, the upper works will have to be scraped clean. The smokestack could be supplanted by a system of forced draft, but the present system of draft as applied to locomotives is extremely simple and effective and does not require a stack of any great height. The sandbox could be placed on the pilot, and the steam dome could be made very small by the use of superheated steam. The top of the cab or cabs could be leveled, and the bell, the time-honored bell which has held its place

so tenaciously through all the changes in locomotive construction, would be obliged to find a new home.

The Mallet articulated type of engine, which has reached its highest degree of perfection in the new Santa Fe locomotives, is practically two engines in one, with two distinct sets of driving wheels. Why not three?

An expert who has directed the construction of some of the largest engines in use today says that on the 500-ton locomotive it would be necessary to place the engineer's cab in front in order that the engineer might have an unobstructed view in rounding curves. The firebox required would have a grate surface of 175 sq. ft., large enough to serve as a garage for an automobile or as a dining room for a large family.



Showing Immensity of Firebox of a Locomotive Weighing 500 Tons

Yet the greatest factor to be considered in the construction of heavy locomotives today is a human one. No mechanical stoker has yet been invented which will, with any great degree of satisfaction, perform the work of the fireman. The giants of the rail have an insatiable appetite for fuel. Coal must be pushed into their maws at the rate of many tons an hour.

It might be found advisable to have two cabs, one in front for the engineer, and one behind for the firemen, provision being made so that two men could shovel coal into the firebox at the same time. Such a locomotive would consume six or seven tons of coal an hour.

The big Santa Fe locomotive uses oil fuel, and that may be the fuel used on the 500-ton monster—when it arrives.

Here geography enters as a consideration which demands attention. Obviously, it would be impractical for roads at a great distance from the source of oil supply to utilize this fuel when they have a vast supply of coal at their very doors.

Some provision would have to be made so that, should the engineer be overcome by death or sudden illness while running his engine, the train would be brought to a stop or an alarm be sounded in the firemen's cab. Electric locomotives are often provided with arrangements for this purpose, such as automatic stops which are brought into action when the hand is released from the control.

Boiler space must be enlarged with the increasing weight and size. The diameter of the boilers on the huge engine being built for the Delaware and Hudson road is a little more than 9 ft. And, although it might be urged that

the coming years may add to the efficiency of the steam engine to such an extent that this size of boiler might serve for the larger locomotive, it is not necessary to depend on this to make the million-pounder possible.

A 500-ton locomotive would be capable of overcoming a train resistance of 250,000 lb., and would haul a train of 30,000 tons, including the engine and tender, on a level track. Placing the weight of freight cars at an average of 20 tons, with an average capacity of 40 tons, a total of 60 tons, this engine would draw 490 such cars. With an average length of 40 ft., this would make a train 3½ miles long. Of course, the drawing bars would not stand such a strain, but it aids in obtaining an idea of the great power of such a monster locomotive.

The speed which could be attained by a locomotive weighing 500 tons is, of course, problematical. It is doubtful if the designers would attempt to make a record breaker of it in this respect, for it has not been shown to the satisfaction of railroad experts that any great increase of speed is advisable under present conditions.

PNEUMATIC BED BATHTUB FOR FEVER PATIENTS

The bath treatment for typhoid fever patients has been fraught with difficulties and danger on account of the peril in moving patient from the bed into the tub. An invention by a Knoxville, Tenn., physician allows the bath to be given in bed and with no more movement than rolling over the invalid. The bathtub, made of rubber, is laid on the bed and the patient moved over onto it, or else it is slipped under him. It is then inflated with a pump, the water poured in, and after the bath is finished the fluid is drawn off and the tub deflated.

Bed Bathtub in Use

Bathtub Deflated and Emptied

¶A lighted cigarette was dropped into an opening in the floor of a Kansas City store and ignited gas escaping from a tiny hole in a pipe. Just above the gas pipe was a water pipe, the lead of which was melted by the heat. This dropping lead, according to the Metal Worker, closed the hole and extinguished the fire.

The Eyes Should Not Need Rubbing

Don't Read with the Light in Front

NEW KIND OF GREEK FIRE

A German naval officer has invented a new kind of Greek fire that may be poured out on the water to block hostile ships or even for attack when conditions are such that the movement of the water will carry the fire towards the enemy. The fluid which makes the fire floats and, it is said, cannot be extinguished. Its composition is kept secret. The old Greek fire, from which it derives its name, was thrown in shells.

Your Eyes Are Your

1. When the eyes have to be rubbed frequently while reading, it is time to consult an oculist.

2. Don't read with the light in front. This ruins the eyesight quicker than anything else. The light should fall obliquely from behind over the left shoulder. Never read with the sun shining directly on your book.

3. Don't go to sleep or even take a nap in such a position that your eyes will open directly on the light when awakening.

4. When a book or magazine has to be held at arm's length in reading, it is a sign that glasses are needed. Don't delay in having your eyes tested.

5. Always hold your head erect when you read and hold your book 14 in. from your face.

6. Use a shade over every light, even a candle. Shades are cheap, or they can be easily made.

Don't Sleep Facing the Light

Most Precious Jewels

To these specific rules, which are illustrated by specially posed photographs printed herewith, should be added the following:

Be sure, when reading, that the light is clear and good.

Avoid books or papers indistinctly printed or in small type.

Rest your eyes every little while, when reading, by looking away from the book.

Wash the eyes night and morning in pure water.

Educators and school officials are coming to realize the importance of safeguarding the eyesight. "Proper care of the eyes," says Ella Flagg Young, Chicago's superintendent of schools, "is one of the essentials of education." She, therefore, recommends that concise directions, embodying the ideas here stated, be printed on the front flyleaf of every school book.

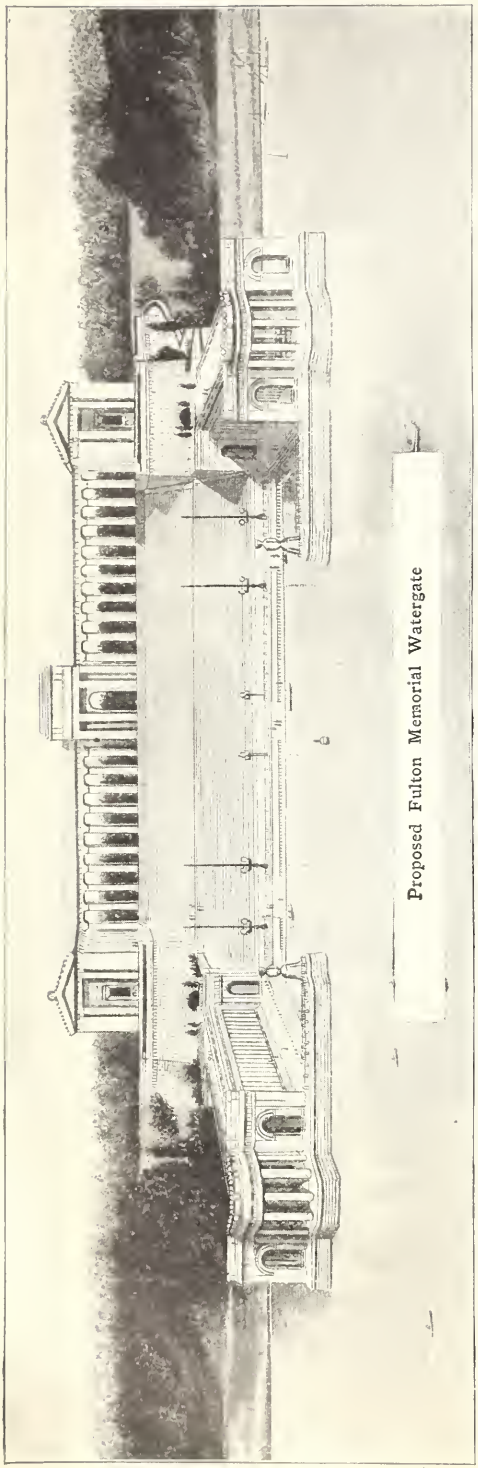
Use a Shade Over Every Light

A Sign That Glasses Are Needed

The Correct Posture in Reading

BRITISH HAVE NEW TYPE OF GUN

A new type of gun, differing from all others in that a mixture of liquid and air is substituted for the springs in the recoil chamber, has been tested by the British war office and found successful. If future experiments prove the idea is adaptable for the large naval guns and that it can be fitted into the existing guns, the gun-making industry will probably enter upon a new phase of development.



Proposed Fulton Memorial Watergate

During exhaustive trials a 14.3-pound gun, fitted with the apparatus, fired ten rounds of shot in succession without relaying. So well did the liquid and air cushion bear the recoil, that the gun did not move and fired five shots with deadly precision into exactly the same hole in the target, a feat which, it is declared, has hitherto been impossible in gunnery.

NEW YORK'S PROPOSED WATERGATE

If the Robert Fulton Memorial Association can succeed in raising the $2,500,000 required, New York will have, for the reception of distinguished guests to that city from abroad, a beautiful watergate which, at the same time, will be a fitting memorial to the great steamboat pioneer.

The illustration shows the design which was awarded the first prize by the memorial association. It consists of a watergate 564 ft. long, to be erected on the Hudson river at Riverside drive, and to extend from 114th to 116th street. At the top of the bank is an open peristyle, in the center of which is shown the tomb of Robert Fulton. A building at the left end of the peristyle is for the reception of guests of the city or nation, and a similar building at the right is designated as a naval museum. A flight of 165 broad steps descend the distance of 90 ft. from the peristyle to the water. Two piers bearing colonnades project out into the river 340 ft., and form a basin 250 by 350 ft. Large vessels bearing guests will have to tie up outside or be forced to anchor in midstream, while small craft will carry the guests into the basin and up to the landing at the foot of the stairs. The flat roofs of the colonnades are laid out as promenades and recreation areas.

The intention is to build the structure largely of steel and reinforced concrete. Some parts are designed as a steel skeleton with a facing of masonry. Nearly all the money required for the project will have to be raised by popular subscription.

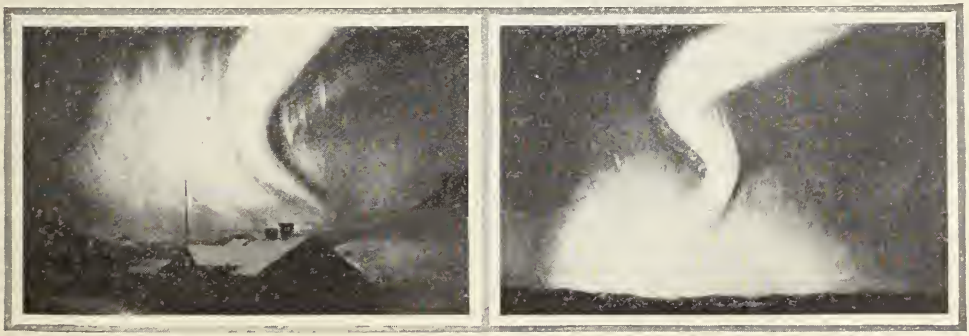
Professor Stormer and Assistant Making Snapshots of the Northern Lights

REMARKABLE AURORAL PHOTOGRAPHS

What are said to be the first really successful photographs of the aurora borealis are shown in these illustrations. They were taken by the Norwegian scientist, Professor Stormer, who led an expedition into Norway.

Until these present photographs, there existed only one good aurora borealis photograph, and that reproduced only one part of an auroral band. It was taken by a German scientist and was blurred because the aurora moved during the 7-second exposure. Professor Stormer's exposures were practically snapshots, the exposure being only a fraction of a second in most of them.

¶The applications for patents in 1909 in the United Kingdom aggregated 30,603, being the largest number but one on record.



Photograph of Auroral Band

Magnificent Auroral Arc

EGYPTIAN NATIVES AND RAILWAY TRANSPORTATION

The accompanying illustration contrasts modern transportation and primitive civilization in a striking manner. The natives are a group of Hedendowas, and the train on which they are riding is on the new Port Soudan line.

Hedendowas on a New Kind of Steed

BLEACHING POWDER USED IN SWIMMING POOL

Hypochlorite has been used so successfully in the purification of the water in the swimming pool at Purdue University that there were no visible effects noticed by the bathers or by those conducting the experiment and no odor.

"The swimming pool contains 85,000 gal. of water," says Professor Burrage, who made the experiment, "and under ordinary conditions has been emptied, cleaned and refilled twice each week, at an expense of from $16 to $20 per week. Analyses of the water in the pool after it had been used gave numbers of bacteria as high as 140,000 per cubic centimeter, while the number of bacteria in the water supply taken from faucets in the same building showed between 500 and 1,000 per cubic centimeter.

"After consultation with several water experts, I concluded to try the hypochlorite and I ran a test without having the pool emptied and cleansed. The amount of hypochlorite used was at the rate of 20 lb. to 1,000,000 gal. (less than 2 lb. for the 85,000 gal.) and the total percentage of reduction of the numbers of bacteria gave 99.8 per cent. The removal of the bacillus coli, which was always present in the water after the pool had been used by bathers, was complete in every case.

"The method of applying the powder was very simple, it being thrown over the surface as evenly as possible by hand, as one walked around the pool. The powder immediately sank to the bottom, dissolving on the way. On entering the pool room the morning after the application of the chlorine of lime, there was no odor whatever noticed. Those who used the pool during the week of the test knew nothing of the experiment that was going on and there were no complaints of any kind."

QUEBEC REQUIRES DUAL LANGUAGE

A dual language law, respecting contracts with public utility companies, has just been enacted in the Province of Quebec, Canada. It provides that all passenger tickets, baggage checks, waybills, bills of lading, printed telegraph forms and contract forms, made, furnished or delivered by a railway, navigation, telegraph, telephone, transportation, express or electric power company, as well as all notices or regulations posted up in its stations, carriages, boats, offices, factories or workshops, shall be printed in both French and English.

The Army of the People

Efficiency of Organization and Character of Men in the Military Service of the United States Shown in Military Tournament on Chicago's Lake Front

By JAMES R. QUIRK

ONE million people were introduced to the khaki-clad soldiers of the regular army at Chicago last month, and two million eyes opened wide in wonderment as they gazed upon a remarkable exhibition of military life and work. As a consequence, Uncle Sam's regular army acquired a million or more of staunch supporters.

Up to within a few years it was the policy of the War Department to make the military as inconspicuous a part of our governmental organization as possible. Although the army was kept up to a high state of efficiency and liberal appropriations were made by Congress biennially, the officials directing our military policies believed in going about the work with the least possible noise. While the Kaiser was parading his glittering regiments at Potsdam for the edification of the world in general and John Bull in particular, and while all the nations of Europe were displaying the pomp and circumstance of their battalions, our War Department kept on dissecting timber and modestly avoiding the glare of publicity.

Roman Riding by Cavalrymen

This was in accord with that feeling of security which has been predominant since the days, when, having wrested independence from England, the colonies set-

tled down to enjoy peace and the fruits of peaceful enterprise under a republican form of government. Favored by geographical isolation from the bickerings of European nations, a standing army seemed unnecessary and inconsistent with the general scheme of things. There was no dynasty to uphold and protect, there were no civil dissensions to suppress, there was little danger of boundary trouble on the north. The Indian uprisings which occurred from time to time could be mastered by the local militia.

Gradually, however, the necessity of a small standing army became apparent even to the most republican of our statesmen. Consisting, at first, of but a few armed and uniformed men to guard West Point and other military stations, this nucleus was increased until in 1784 the standing army numbered about 700 men.

The idea of a huge military force which would be a drain on the nation is repulsive to Americans, and they are inclined to look with a pitying eye on the soldier-ridden nations of the continent. There are those who declare there is no need of any standing army, but they fail to realize that humanity has not yet reached that ideal stage upon which the perfect brotherhood of man may become a glorious reality.

In other countries the public is constantly in touch with the army. In some of the cities of Europe the soldiers almost equal the civilians in number. But in this country it is different. Although barracks have been located so strategically that a regiment or so could be poured into most of the large centers of population in a surprisingly short time, it has been the policy not to locate garrisons in any of the large cities. When the soldier is seen in the city, it is ten to one he is in the act of separating himself from his month's pay with that abandon for which he and the sailor are noted. The impression is left in the mind of the city dweller that the soldier is a lazy loafer, who, temperamentally opposed to labor in any form, joined the army as a means of escaping it. That impression of the American soldier may have been justified at one time, but today it is decidedly wrong. True, the enlisted man escapes some of the responsibilities of life that fall to the average lot in civil life, but, stripped of all its glamor, life in the service of Uncle Samuel is not a sinecure.

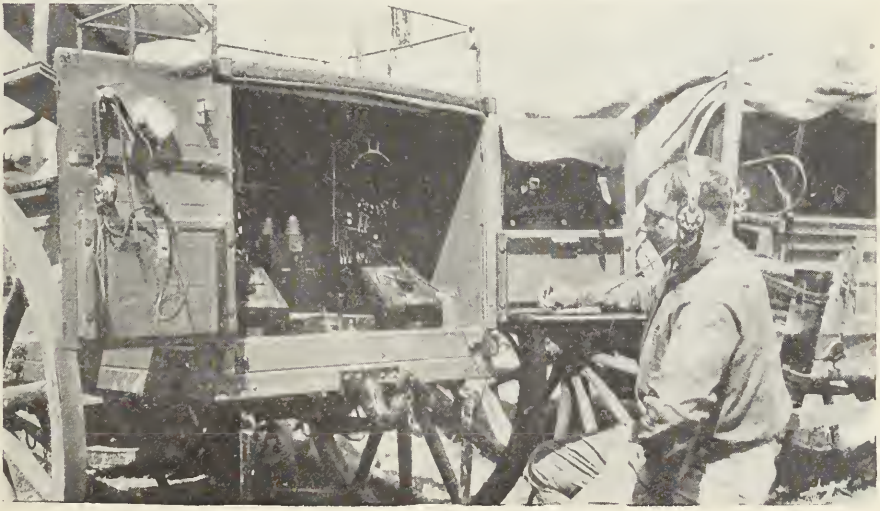
Gen. Frederick D. Grant, U. S. A.

The man in the ranks has no greater friend or supporter than Gen. Frederick Dent Grant, who, as commander of the Department of the Lakes, was in charge of the recent army tournament at Chicago. The affair was in the nature of a personal farewell to the people of that city, for at the close of the maneuvers the General proceeded to New York to command the Department of the East.

"A wrong impression as to the character of the American soldier exists in the minds of many people," said General Grant to the writer. "And it prevails to such a large extent that it

The Demolition of the Trestle Bridge with a Bomb, Baffling Pursuing Cavalry

In 50 Seconds a Battalion Broke Mass Formation and Erected Shelter Tents



Receiving Messages at the Portable Wireless Station of the Signal Corps

On the Firing Line

Erecting the Trestle Bridge

was thought advisable to show the people of the United States just what the soldier does and is. The recent practice marches attracted a great deal of attention in the communities through which the troops marched, and this led to the idea that it would be a good thing for both the army and the people to hold military tournaments in some of our large centers of population.

"Our standing army numbers about 80,000 men. Roughly, that is about 800 to every million of population, eight to every thousand. Out of every ten applications for admission to the army, one is accepted. It might be said, therefore, that the army is composed of picked men. We have, as a rule, men who are above the average in physique, and I may say, in intellect. They may not be highly educated, but they can all read and write.

"We want the American people to realize the sort of an army they have and to appreciate it. That they do, when they are given an opportunity, was shown by the Chicago tournament. The work done on that occasion was not a series of specially staged circus stunts. It was merely a representation of the regular work done at the garrisons. Some of the more difficult riding was done by men who have served two or more years in the cavalry, but then again three-fourths of the men in one of the regiments were enlisted since April and one-half their number since June.

"I think these tournaments will awaken the people of the United States to an appreciation of the army and its importance in the affairs of the nation. The courts are generally looked upon as symbolic of the 'majesty of the law.' But the courts merely interpret the law. The real majesty of the law is the force behind it—the sword."

Infantry, cavalry, artillery, engineer corps, signal corps—in fact, all branches of the service were represented at the military show on the lake front of Chicago. The tournament was secured for the city by the energetic work of the Sane Fourth Association, which has been endeavoring for several years to divert the interest of the small boy, as well as his elders, from the deadly firecracker to a more rational celebration of the day. It was a strange coincidence that the park in which the encampment was made was named after the famous father of the general in command. Located in this park, too, and gazing down on the martial scenes, was the equestrian statue by St. Gaudens of General Logan, the great volunteer soldier of the Civil War.

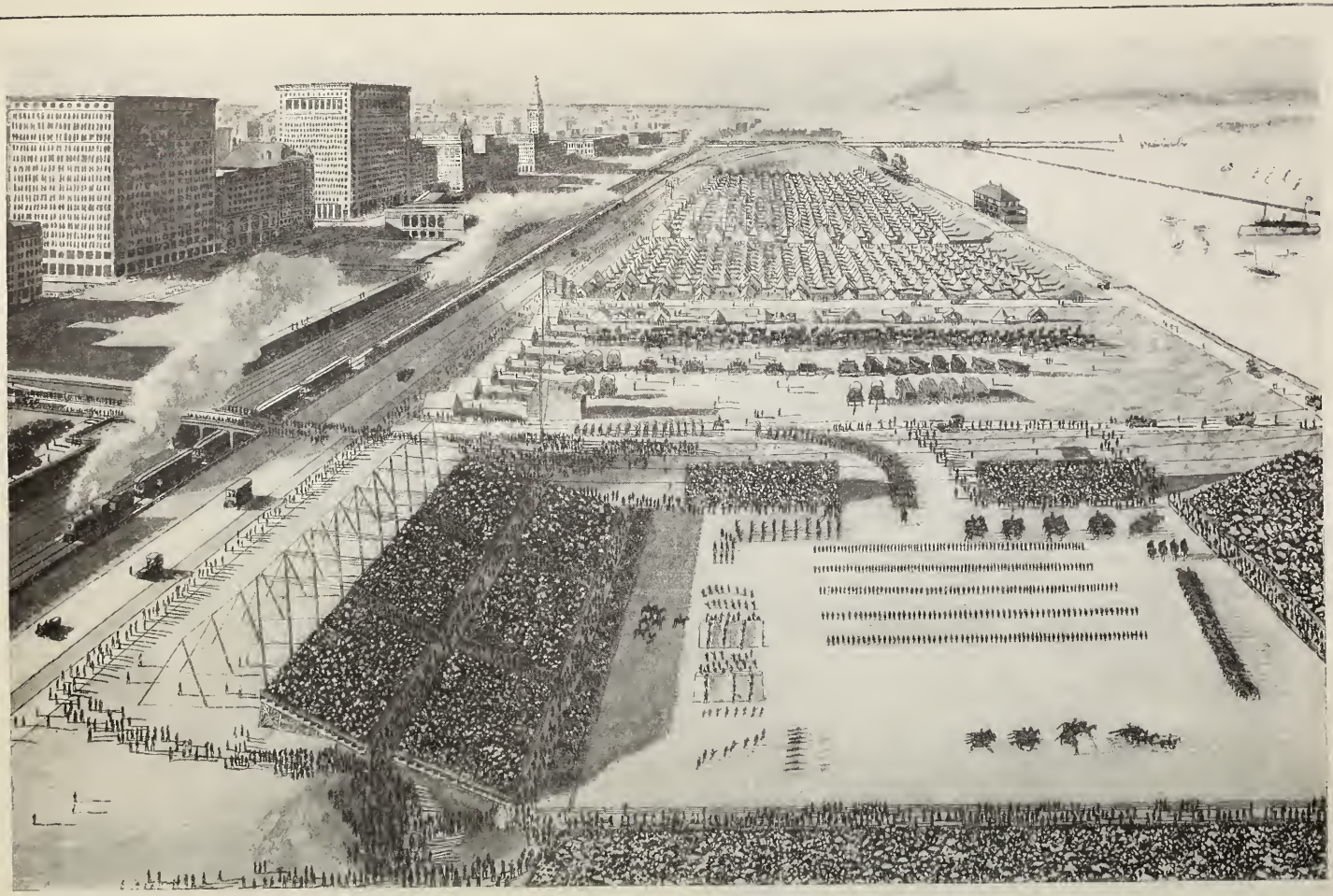
Extending for half a mile between the skyscrapers of Michigan Avenue on one side and the lake of the same name on the other, the camp presented an inspiring sight. At one end was an immense amphitheater, 600 ft. long and 400 ft. wide, providing an open space in which a regiment could maneuver. The seats on the sides accommodated 40,000 people and most of the seats were free.

Not content with viewing the performances in the arena, the public flocked through the company streets and thus obtained an intimate view of the soldier's way of life in camp. The visitors saw the field hospitals, the portable bakeries with a capacity of thousands of loaves of bread a day, the cook-houses, the mess tents, the wireless telegraph and telephone outfits and the hundred and one things which go to make up such an encampment. To most of them it was a revelation. They had expected to see the machine guns, the Red Cross tents and the military searchlights, but who would have expected to find shower-bath tents at frequent intervals and field pieces, invented and adopted by the French only six months ago and secured and copied by our ordnance experts within such a short time? Our army behind the times? Not a bit of it. This should be modified somewhat, however, for we are lagging behind in one direction —in aeronautics. The officers are given to gloomy moods when they refer to the manner in which Congress turned down the half-million-dollar ap-

Regulars Advancing on the "Enemy" by Short Rushes After Scaling Wall

Infantry Scaling a Twelve-Foot Wall

Mounted Sabre Drill—Note Helmets and Padding to Prevent Injury



Birdseye View of Grant Park, Chicago, During the Military Tournament—Amphitheater in the Foreground

propriation for developing this branch of military activity. But they are confident that the army will not be found wanting even in this regard when need occurs.

The performances in the vast arena constituted the most comprehensive demonstration ever made in time of peace of the organization and efficiency of the army. There were no gorgeously uniformed and metal-breasted cuirassiers, no officers decked out in brilliant colors and gold braid. In action it was difficult for the civilian to distinguish a private from a colonel, for even the commanding general wore the serviceable khaki. There was little of the pomp of war. It was too scientific for pomp, too businesslike, for with that very equipment the troops would be prepared to go to the front in an hour's notice.

Some of the most spectacular work was done by the cavalry and the engineer corps, but the rapid evolutions of the artillery, the precision of the infantry, and the remarkably quick work of the signal corps, all evoked the enthusiasm of the spectators.

The construction and demolition of a trestle bridge under fire by the engineers aroused admiration. The bridge, about 100 ft. long and strong enough to bear heavily loaded, six-mule supply wagons, was thrown up in a few minutes. First, the upright supports are placed and connected by heavy timbers. A squad of the engineers takes a position some distance back to cover the men engaged in the work and protect them from the fire of the enemy. While this squad is cracking away at the supposed enemy with their Springfields, the covering is being placed over the timbers with amazing rapidity. Every man has his place and his work. One stands on the wagon, handing down lumber as fast as he can, another is posted at the end of the wagon, and others at necessary intervals, so that the piece is just handed from one man to another until it is put in its place. Every piece moves at a predetermined speed and this never varies. The covering laid, it is fastened down by rope, laced over and under the ends of the pieces, so that every piece is secured.

The fire of the enemy is becoming hotter. One detachment begins the retreat across the bridge and when over, covers the remaining troops and supply wagons. The wagons then rattle over the structure until the last detachment crosses. The cavalry of the pursuing force appears and charges the bridge. But the last infantryman has no sooner cleared the bridge than a bomb demolishes the structure, and the cavalry is baffled.

All this was accomplished in far less time than it takes to tell it. In fact the bridge was blown up just five minutes after the uprights were placed and the work of construction begun.

A feature that gave an insight into some of the hardships of the soldier on the march was the construction and breaking up of shelter camp. A battalion of the Twenty-seventh Infantry trotted onto the field and, under orders given by sharp whistles, executed a mass formation and divested itself of blankets and tents. A series of short, sharp whistles, and the mass becomes animated and confused. Within less than 50 seconds the shelter tents, one for every two men, have been erected, and the battalion has disappeared within them. Shots are heard in the distance. A sharp bugle blast arouses the apparently sleeping soldiers. Within 60 seconds the shelter tents have been taken down, and the battalion is massed in close formation to repulse an attack.

The manner in which a battalion of infantry can scale a high wall was graphically shown. Repelling the enemy's men who are posted on the wall, the troops, mounting on one another's shoulders, clamber over, and advance by short rushes. The problem of the last man is easily solved. To the lone soldier a rifle is lowered by strong hands, and he is yanked to the top and over with surprising speed.

While this sham battle was going on, a glimpse of the Red Cross in action

was presented. The ambulance corps followed close on the heels of the fighters and the instant a soldier fell, two men with a stretcher appeared and hurried him to the ambulance and to a hospital tent hastily erected in the arena.

The Sixth Cavalry presented what appeared to be an almost reckless exhibition of fencing on horseback. The helmeted and padded horsemen pummeled each other with broadswords with a violence that caused the spectators to rise to their feet with excitement. The horses kicked, reared and bucked, while the riders were compelled to manage them, maintain their seats and protect themselves from the onslaughts of their antagonists.

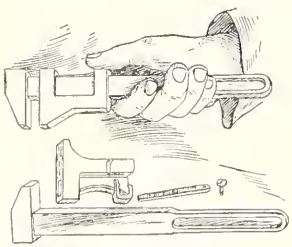
Two other events, in which the expert riding of the troops was exhibited to the best advantage, were the cavalry bareback riding and the artillery drills. After various feats of rough-riding and hurdle-jumping—feats, by the way, which would make the average circus performer envious—the cavalrymen formed themselves into companies and then climbed, pyramid fashion, on the shoulders of four horsemen. Each pyramid, mounted on four horses, then galloped around the inclosure, leaping hurdles, while the spectators held their breath in fear.

The character of the work done by the signal corps is such that it does not lend itself readily to spectacular exhibitions. Yet the showing by the corps in the big arena was readily appreciated and admired. In a remarkably short space of time the wireless wagons were dashed across the field, the pole erected, circuits established, and communication opened. The sputter of the sparks could be heard in all parts of the amphitheater. Communication was established just one minute from the time the wagons were brought to a standstill on the field. The signal corps received the reports of the prize fight at Reno on July 4th by wireless and flashed the news of the downfall of Jeffries throughout the camp.

The government at Chicago opened its new policy of bringing the public and the army together. It is willing, too, to introduce the people of other large communities to the soldiers in like manner. The result will, no doubt, be an increased pride in the country's defenders.

NEW TYPE OF ADJUSTABLE WRENCH

A wrench, that can be adjusted to take hold of different sized bolts by a simple pressure of the finger, is here illustrated. It consists of a combined upper jaw and handle, a lower or sliding jaw, an adjustment spring and a steel rack set in the lower face of the handle, the two last named devices constituting the difference between this and the ordinary wrench.



A slight pressure of the thumb at the back end of the sliding jaw depresses it against the resistance of the spring and releases its engagement with the rack. It can then be opened or closed to the desired extent, when the release of pressure on the spring causes it to again engage with the rack.

¶Sharpening the bits of 300 rock drills used in the Calumet & Hecla mines is done automatically, the only labor being to put them on a conveyor at the outset. They are heated, sharpened, upset, fluted and brought back to exact size and diameter by machines passing from one to the other mechanically.

¶Another use for aluminum has been found in combining it with gold to produce a metal that is said to possess a beautiful color, adaptable for wide use in the jewelry trade.

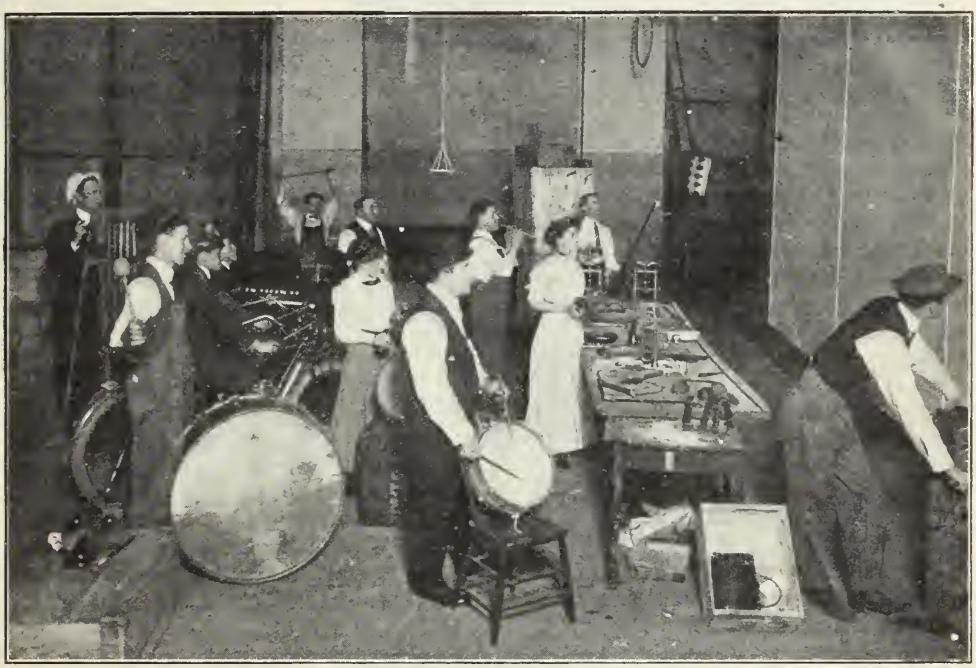
HOW THE MOVING PICTURE SPEAKS

The ordinary moving-picture exhibition is silent save for the whir of the machine, but prominent exceptions to the rule demonstrate how much more wonderful the exhibition is when every sound that accompanies the action the pictures reproduce is also given.

The manufacturing of sounds for a moving-picture show, however, is far from simple, if the sounds are to seem real. Indeed, it is quite complicated, and necessitates a troupe of trained actors as large as is required to produce many plays, although those taking the parts never appear before the audience.

Before it is possible to make the pictures speak, the most careful rehearsing has to be gone through. This is done by running the pictures slowly, with full explanations. Words, sentences, disjointed exclamations, imitations and mechanical noises are interspersed, and not until every person knows his part and can read the pictures from behind the screen is the film shown in public. For his cue, the moving-picture actor must glue his eye to the rapidly-moving views on the screen, alert to manipulate the proper sound-producing device, or speak at exactly the right moment. Should he be a moment too soon or too late, the realistic effect would be spoiled.

In the illustration is shown a company of moving-picture actors and the numerous sound-producing instruments provided for their use. Prominent among them are two motorcycles, the engines of which are operated when a race is being shown on the screen; an organ, to be used for its natural purpose if the screen requires, or for ingenious imitation work at other times; wind and thunder machines, bells, whistles, drums, musical tubes and irons, and many other devices ingeniously adapted to the purpose.



Making the Moving Picture Speak

A THREE-KEY LOCK

A lock-making concern in Australia is finding a ready sale for a type of lock that requires three keys to operate.

Given by Empress Eugenie to Charlotte Cushman

It is in reality three locks in one, connected in such a way that the keys must be used in the manner specified in the combination. In one lock, for instance, the three keys, numbered 1, 2 and 3, must be used in this order to unlock, and used in the reverse order to lock up. It is called a "trustees' lock," as it is used in many instances where the property secured is in charge of three trustees, each being intrusted with one of the keys.

A FAN WITH A HISTORY

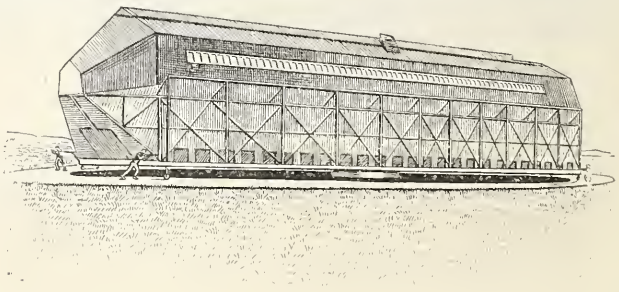
The treasure of one of the world's greatest actresses and before that, of one of the most famous queens in history, a fragile toy wrought of mother of pearl, gold and the toil of the artist's brush, the desire of every antiquarian in America—in short, the fan that the Empress Eugenie gave Charlotte Cushman, is in the possession of a Boston collector.

It is a beautiful thing, even without its associations. The sticks are of mother of pearl, inlaid with flowers of gold, while the fan itself is covered with symbols and flowers of gold and crimson, little dimmed by the years that have elapsed since the artist first laid them on.

Long ago the fan belonged to the Empress Eugenie, and formed part of the trousseau she brought to France as the bride of Napoleon. It was one of her most treasured possessions, but with characteristic generosity, when the American actress, Charlotte Cushman, played before her, delighting the empress with her acting, Eugenie plucked it from the chain about her neck and gave it to the young American. How Charlotte Cushman ever came to part with it is unknown, but, for some reason, she gave it to an understudy and later it came into the possession of a western woman, from whom the Boston collector secured it.

REVOLVING AIRSHIP SHED OF STEEL AND CANVAS

The difficulty of maneuvering large dirigibles into the great sheds constructed for them has caused a German concern to construct a revolving shed for the purpose. When the airship is about to land, the shed is turned until one of the entrances is immediately in front of it. The shed has an entrance at each end, and stands on a circular platform, on which it revolves. The construction of the shed is steel skeleton work, with a canvas covering which can be rolled up when extra light is required for repairs.



Revolving Shed for Dirigibles

THE AEROPLANE AND THE BATTLESHIP

Powerful Naval Fighting Machines Will Always Determine Destinies of Nations, Unmenaced by Aerial Craft

By

CAPT. RICHMOND P. HOBSON

FLIGHT as a problem can be looked upon as solved. We are now in the second stage, that of development, and are on the eve of the third stage, that of practical application.

In all ages, the human race has dreamed of conquering the air. Other conquests have only intensified this, the deepest of human longings. The conquest of the land took ages, and the conquest of the sea yet longer ages. In both cases progress was slow and tedious, step by step. Ballooning has been in progress of development for generations, but flight in the aeroplane is the result of a few short years at most. In one leap, man has now made the conquest of the medium that envelopes both land and sea, thus making complete his proud dominion over the earth.

Capt. Richmond P. Hobson
Member of the Committee on Naval Affairs of the House of Representatives

The startling swiftness of this mighty conquest has fired the imagination of the world and speculation has run wild as to its effect upon human life. At such times, hasty conclusions in the public mind may even lead to public policies founded upon error and leading to disaster.

It is high time that authoritative and popular publications, starting from fundamental principles and following the great laws of nature from cause to effect, should get the bearings, map out the course, and point the true lines of development and the applications of the new art to activities on land and sea.

From the time when the morning stars sang together, questions of combat have had the foremost interest for man as for all living things. It is in combat of some form that individuals, types and species, of plants, animals and men have survived or perished, and are now in the process of perishing or in preparation for surviving.

The law of co-operation has been invoked primarily to enlarge the powers of combat, causing families to unite into clans, clans into tribes, tribes into nations, and nations to develop. Common defense has been the cause of and primary bond of union in every nation of the world, and will be the cause of and the primary bond of union as the nations group themselves into compact races.

It has been natural and inevitable that every new invention and discovery should be adapted instantaneously to the purposes of war. Indeed, purposes of war in offense and defense have caused the chief developments of materials and power, in quality and in size, and in application to engines and structures.

It is perfectly natural therefore, that with the sudden appearance of the aeroplane, the thought of men should turn instantly to its uses in warfare and that the popular imagination should lead to startling conclusions, particularly as to naval warfare, so fascinating and so little understood.

Great Speed Attainable in the Air is Only an Auxiliary Agency of Offense

In the popular mind, modern naval warfare is correctly typified by great battleships. One and embodied in the combines more power, of these mighty engines than did whole fleets of offensive and defensive, the cost has gone up as a few years back, and high as $12,000,000 and is still rising. It is natural that the thought of the whole world should turn to the effect of the aeroplane upon the battleship. Is it possible that one of these great costly battleships could be destroyed by one or more cheap little aeroplanes? Is the day near at hand when the aeroplane can go into combat with the battleship and have a reasonable chance to win?

The experience of nature is usually a fair guide for man. In the realm of the air, nature has evolved but one main weapon, the beak, and one auxiliary weapon, the talon. An additional main weapon, the spur, has only been evolved where the feathered creature remains upon the ground. In weapons, nature has found it impossible in the air to match the fang, claw, tusk, horn and hoof of the land, and the tooth, tentacle, fin, saw and sword of the water. The great speed attainable in the air is only an auxiliary agency of offense.

In the air, nature has undertaken no provision for defense direct. Feathers, primarily for sustaining power and for speed, are only auxiliary in defense. Nowhere do we find the special developments of hide, bone, shell and inaccessibility of vitals, found in combatants of land and water. The great speed of the air is defensive in the sum of aiding escape.

"The Aeroplane Has Come Like the Torpedo and the Submarine, but the Battleship Remains and Will Continue to Remain King"

Of forms, there is but one combatant type in the air, that of the eagle or hawk, and the maximum size is limited to a few pounds. On land and in the sea, the combatants are multiple in form and extend to tons in weight. Nowhere in the air do we find nature exhibiting the titanic combats so common between the beasts in the jungle and the great fish in the sea.

Never yet has the bird of prey been a menace to the beast of prey or the fish of prey. If actual combat took place, the outcome could be but one way. The bird could avoid combat, but choosing combat, and unable to lift the beast or fish into the air, it would of necessity be vanquished.

There must be some great principle underlying these evolutionary limitations of nature in producing combatant power in the air. It is the difficulty of sustaining any considerable weight in the air. The bulk of the activities and energies must be devoted to sustaining the bare weight involved in life itself, keeping the total weight down to a minimum, and developing the maximum energy per unit weight. Nature could find but a small margin of weight and energy available for purposes of combat. Indeed, so exacting and exhausting is the effort to sustain weight in the air, that nature has not evolved a single bird that remains permanently on the wing, nor even insects or other forms of life, animal or vegetable, capable of remaining suspended in the air and propagating their species in the air, as are found so prolifically on the land and in the sea.

When the Torpedo Was Invented, the Battleship Absorbed it as a Weapon

It is the same nature that has done its best in the air, in the sea, and on the land. It is the same man who will do his best in all three realms. He finds and will continue to find the same inherent limitations that nature found, and the presumption is that his aerial engines of combat, built under the limitations of the air, will bear about the same relations to his engines of combat on land and sea as the combatant power of birds bears to the combatant power of beast and fish. While combatant birds have a limited sphere of action against non-combatant beasts and fish, they have almost no sphere of action against combatants of land and sea.

In contrast with the limitation upon size imposed upon aeroplanes, there is not only no limit imposed upon the battleship, but there is a fundamental advantage in larger sizes both in the strategic advantage of concentration of power and in greater efficiency for each unit of weight and cost. The dead weight of the hull, broadly speaking, is like a surface, and varies with the cube of a line or dimension. The larger the vessel, the greater the proportion of total weight available for power. A single vessel of 30,000 tons can be built with the power of three vessels of 15,000 tons. Consequently, the size of the battleship has increased and will continue to increase.

It must be assumed that this expansion of size will

always enable the battleship to be built to utilize any and all new engines of war. When the torpedo was invented to be used against the battleship, the latter promptly absorbed it as one of its own weapons. When the torpedo boat was introduced, the battleship promptly put torpedo boats on its own deck and arranged for torpedo boat destroyers to be in attendance.

In comparing the aeroplane and the battleship it must be remembered that just in proportion as the aeroplane proves formidable, will the battleship provide to carry aeroplanes on its own decks and to have aeroplane destroyers in attendance. Furthermore, the size and availability of weight, will enable the battleship to be a constant, ever ready base of operations for its own aeroplanes, aeroplane destroyers, and small dirigibles and captive balloons, whereas, under the best conditions, the attacking aeroplane can operate but a short length of time away from its own base. Aeroplanes, in attack, can only make sallies and cannot follow a fleet and wait for the best conditions for attack.

The most effective work of aeroplanes will doubtless be done by those that become part of the equipment of battleships, chiefly for purposes of observation and scouting. With an understanding of these fundamental limitations imposed upon flight, whether evolved by nature or by man, we can proceed intelligently to examine the question of the attack of the aeroplane upon the battleship.

The Aeroplane Can Choose or Decline Combat, and Can Choose Altitude

The speed of battleships may now be regarded as approaching 30 miles an hour. With the increase in size, the speed will increase, but the resistance begins to absorb power more rapidly with the increase in size of the vessel. This resistance places a practical limit upon the speed of ships. No such limitation is imposed upon the speed of aeroplanes. The great speed of birds compared with speed of fish, indicates nature's relative achievements. The lifting power of an inclined plane increases with the square of the speed. It may be said roughly that there is no limit to the speed of aeroplanes and that there is decided advantage in increasing the lifting powers through increase of speed, rather than increase of size, particularly in fighting aeroplanes.

The speed of aeroplanes may be regarded as already double the speed of battleships. We must expect it to go on up to three, four, five, six times and even higher multiples. Consequently, our first conclusion is that the aeroplane can choose or decline combat; can choose its own altitude, can choose the direction of approach, and can dash through the zone of fire with astonishing speed. To meet such conditions, the battleship could have out its aeroplane scouts, and destroyers, aeroplane and dirigibles, or in cruising, its kites carried by its own speed, or carried by its torpedo boat

destroyers or other auxiliaries. It could have its dirigibles out for extended scouting and hold its aeroplanes ready for launching upon a signal of alarm. At this juncture, without reference to the question under discussion, it may be noted what wonderful scouting service aeroplanes will render fleets in their regular operations in locating the enemy's fleet, and establishing his strength, his course and formation. In this kind of work, there will be dashing achievements and thrilling races and encounters in the air, offering a tremendous incentive for skill and the development of details.

In case of a number of battleships operating together as they would do in war time, the use of all the squadron or fleet auxiliary torpedo-boat destroyers, together with special captive balloons, dirigibles and aeroplanes carried by large auxiliaries, and the fleet's flotilla of aeroplane destroyers as scouts, would not only make the chances of surprise very small, but would practically insure running the gauntlet of attack from sea and air, before the aeroplane attack could reach the battleship. To have any hope of attacking the battleships proper, the attacking aeroplanes would have to be in large numbers, dashing from all directions at the highest speed attainable.

Assume that the attacking aeroplanes were sent in droves and under the picket bers got through, over caped destruction from lines of the air and es of the auxiliary vessels, the fire of the outposts tleships—what would and dashed for the battle? be the chances of bat

Missiles of Aeroplane Must be Dropped by Gravity or Trailed and Applied Direct

The limitations of weight imposed on the aeroplane practically eliminate its use of weapons of precision other than those of the smallest caliber, small arms and automatic machine guns, which have no effect upon battleships, though they will be prominent in combat with air craft. The aeroplane's offensive power against battleships will be limited to missiles trailed and applied by direct contact, or dropped by gravity from above. An aeroplane of high speed and power could only carry a very limited number of missiles of power. It is a question whether it could carry one missile with power enough to sink a battleship even under the most favorable conditions of explosion. To apply its missile it must reach the zenith of the battleship and pass through a zone of fire extending out 10, 15 miles or beyond, from artillery of the greatest precision and power. Of course the battleship could have special ammunition of abundance adapted to this work for all big guns, up to the highest caliber. The 12-in., 13-in., 14-in. guns would hurl special shrapnel, each one of which would create a wide zone of destruction. No aeroplane could advance in the face of such a fire.

If fire opened at ten miles it would take an aeroplane going at the rate of 150 miles an hour four minutes to reach the zenith and each of even the biggest guns could make four or more

shots. Of course elevating guns and port holes would be arranged so as to permit quick, accurate elevation as high as the zenith. At the present stage of ordnance, it would be easy, not only to adapt all existing guns for aerial firing, but to make special guns for aerial defense, guns that would maintain a constant wall of shot against which the aeroplane would have to hurl itself.

Only in approaching at high altitudes could the aeroplane have any well founded hope of actually reaching the zenith. A low flight in which a missile could be trailed or dropped with any precision could only be possible on the assumption of a complete surprise, the absence of all precautions on the battleship, or an extraordinary condition of night, fog or storm, permitting the aeroplane to see the battleship while itself unseen and unheard, conditions that must be regarded as accidental. At dusk and at night the ship has the advantage of vision.

On the other hand, if the aeroplane approached at high altitudes, her offensive power would practically disappear, for with the small number of trials the chances of hitting are practically negligible, depending on the exact determination of the vertical, exact determination of the altitude, exact estimate of distances on the earth, accurate knowledge of the speed of the aeroplane, not relatively to the earth, but accurate allowance for this unknown speed, accurate allowance for the retardation of the weight of missile in particular form and through air varying passing laterally allowance for the de- in density, accurate variable air currents flection of unknown and below and accurate allowance for the unknown speed of the battleship in its undetermined course, relative to the course of the aeroplane. Suppose the aeroplane were flying at the rate of 70 miles an hour or 100 ft. per second, and dropped its missile from 2,500 ft., the missile would advance 1,250 ft., more than twice the length of the largest battleship. A hit would be an accident.

Offensive Power of Aeroplane, Except Against Air Craft, Almost Negligible

Examination thus shows that in practice the offensive power of the aeroplane, except against air craft, is almost negligible as against the whole, titanic battery power of the battleship. It must be further remembered that a battleship within its own resources can avail itself of the use of aeroplane destroyers, and also captive balloons and dirigibles with developed powers of offense against aeroplanes.

The limitations of weight practically deny to aeroplanes the development of defensive power through materials of resistance, and entails a comparatively fragile construction with little recourse to the use of parts in cases of damage. Being heavier than the medium in which it travels, it becomes helpless with any serious derangement of the power to create movement. With any aeroplane, the sustained speed has comparatively narrow limits, and descent becomes necessary when the speed drops below a limit that is com-

paratively high, especially with high-powered planes built for high speeds. Furthermore, even slight derangements in the mechanism of control or in the symmetry and balance of the plane or planes necessitates descent. Any considerable repair work in the air is practically impossible. Thus the aeroplane is now and must remain a most fragile implement, without any power of defense, subject to fatal derangement by even the smallest missiles that can be hurled with precision by thousands and tens of thousands in destroying clouds from a battleship. The only defense of the aeroplane is its great speed, but even here a battleship properly equipped for the purpose, can interpose in front of it a destructive dust of missiles.

It is not necessary to detail the great defensive elements of the battleship structure, even in its present construction. It will be found difficult, if not impossible, to sink or destroy a modern battleship by a single blow, even below the waterline, except in case of the most powerful mine explosion. How can it be expected to destroy such a vessel by a single blow from the air? Of course the aeroplane's missile will be of sensitive explosive of highest power, dynamite or explosive gelatine at the present time. It could not be hoped to have such a missile pass through the superstructure and upper decks and reach the protective deck before explosion. Any claim of armor penetration is out of the question.

Battleship Can Readily Adopt New Applications of Armor and Construction

Even if it did pierce one of the protective decks, it is hardly conceivable that the ship would be destroyed by a single explosion of any missile limited by the weight an aeroplane could adopt, for the ship's vitals are in multiple units and the structure is such that damage is localized. The luckiest missile from an aeroplane would be one that missed the ship, but fell close by and exploded under water and produced a disrupting mine effect to crush in the lower under-water structure. In this way, the target for the aeroplane is increased by a wall of water around the ship. If the aeroplane drops a charge of 100 lb. of dynamite or explosive gelatine, the width of this wall may be regarded as about 20 ft., assuming that the pressure required to disrupt the structure is 5,000 lb. or more per square inch.

Already the sides and bottom compartments of battleships are built to cushion and localize the blow from torpedoes and mines, when the weight of explosion will far exceed the weight practicable in aeroplanes. Structurally the battleship embodies now great defensive power in the use of armor and arrangement of construction, expected to withstand without vital injury scores of blows as heavy as those the aeroplane can hope to strike. In addition it can readily adopt new applications of armor and construction, if needed, against missiles dropped from above. It is readily seen how wire nettings could be carried high up, at two or more heights, capable of explod-

ing if not of stopping missiles dropped from above, the lower net being designed to catch fragments. Indeed, with adaptations, special captive balloons could maintain such a net high in the air, and at the same time employ small weapons against approaching aeroplanes. It is easily seen how, in firing at the aeroplane, the missiles mounting to the zenith in large numbers would tend to explode any missile dropped with accuracy. Indeed, special guns and ammunition could be devised to keep a shower of missiles constantly ascending to cover the zenith in the same way that a cloud of missiles could be kept in front of an aeroplane.

The battleship's speed is a source of substantial protection in reducing the accuracy of missiles operated only by gravity, and this speed is easily made variable in both direction and velocity when aeroplanes are approaching. At night and in the gloaming, the searchlights from torpedo boat destroyers and other auxiliaries, sweeping the heavens and resting on the aeroplane or aeroplanes, would interfere with the latter locating battleships with lights screened, until the guns of the ships opened up with a pour of annihilation.

The limited offensive power of the aeroplane contributes almost nothing in the way of defense, while the whole battery of power of the battleship is a direct factor of defense in preventing the aeroplane from reaching the zenith. It must also be remembered that in defense, as in offense, the battleship can command the services of air craft, aeroplane destroyers, dirigibles, and captive balloons.

Projectiles of Small Size Can be Hurled Literally in Clouds from Battleships

CONCLUSIONS

1. The presumption drawn from nature is borne out by careful investigaton. Allowing for all possible developments, the inherent limitations upon the combatant power of birds will always be imposed upon aeroplanes. An eagle cannot fight a lion, neither can an aeroplane fight a battleship.

2. Having no limitation upon its size and weight a battleship can always be produced with power to utilize aeroplanes and also dirigibles and captive balloons. It is to be assumed that as a torpedo boat defense is thrown out against torpedo boat attack, air craft defense will be thrown out against aeroplane attack. The latter is the simpler for, while a torpedo can be launched with some precision from any direction, an aeroplane must reach the battleship zenith before it can drop its missile.

3. The one matchless quality of the aeroplane is speed. Future speeds will exceed anything now dreamed of. However, so many combatant necessities have to be sacrificed for this speed, that the latter, as in the case of birds, avails but little for combat except in the air. In fact, the very speed of flight entails a heavy loss of accuracy in firing or dropping missiles. Great superiority in

speed, however, does give the aeroplane the power to accept or decline combat. The probability is that this power will be used in practice chiefly to decline when a battleship's zone of fire approaches.

4. The offensive power of the aeroplane against the battleship is very small. Unable to carry weapons of precision and ammunition, its only weapon is a package of explosive propelled by gravity. To fire at all, it must reach a particular line of bearing, the zenith of the battleship. To reach this it must pass through the zone of fire. At a low altitude the defenseless aeroplane would, almost certainly, be annihilated; at a high altitude there would be very little chance of hitting the battleship, for then the error of dropping from a moving object upon a moving object is very great, nor could the aeroplane manoeuvre and make many trials to correct error, or drop a stream of shots in succession when it employs missiles of low power, incapable of inflicting serious damage.

The defensive power of the aeroplane is practically nothing. Delicate, complicated, fragile, without means of repairing damage, serious and fatal injury can be inflicted upon it by projectiles of comparatively small size, which can be hurled literally in clouds from the guns of the battleship.

Aeroplane Missile Could Not Pass First Protective Deck of Battleship

5. The offensive power of the battleship enormous. All of its guns can be adapted to aerial firing and special guns mounted. If the offensive powers of the battleship against the aeroplane are carefully developed, there is no doubt that they can be made literally annihilating.

The defensive power of the battleship is likewise enormous. With special fittings or equipment a battleship could explode a missile high above its decks, but even if an aeroplane did reach the zenith and drop a missile accurately, and it was not caught by a netting or exploded, having no penetrating power it could not pass the first protective deck, and its blow, under the most favorable circumstances possible, would be localized.

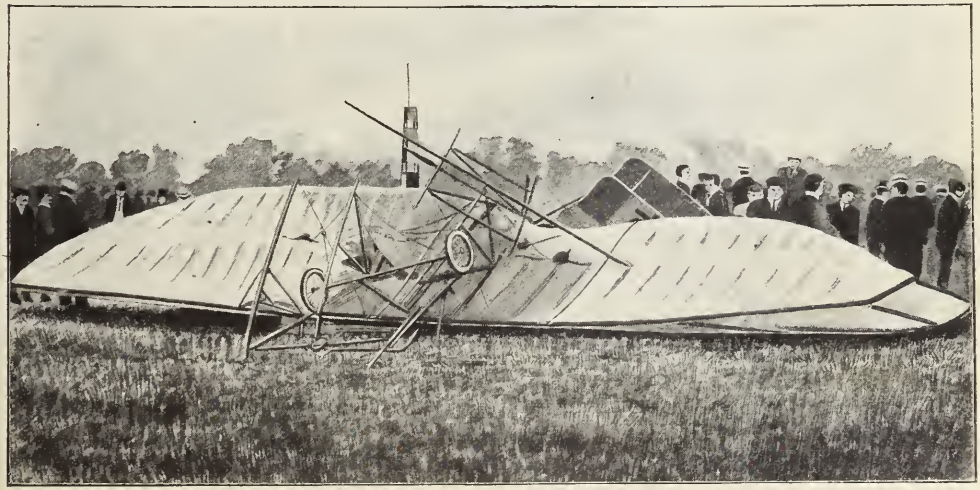
6. With the defensive power of the aeroplane very small against the great defensive power of the battleship, and with the offensive power of the battleship to annihilate, there can be no real combat between the two.

The aeroplane has come like the torpedo and the submarine, but the battleship remains and will continue to remain king, and will continue to grow in size and power, and will continue to determine the control of the sea and the issues of war, and the rise and fall of nations and races.

JULY AN EVENTFUL MONTH IN AERONAUTICS

As the past year has brought about some of the most remarkable developments in aviation since flying became practicable, so the month of July, 1910, must be given place in history as a record-breaking period in point of achievement as well as for the number of unfortunate accidents. Half a dozen or more records were broken, plans for long-distance flights from New York to Chicago and to St. Louis were made and eight lives were sacrificed. Independence Day was celebrated in the United States with aviation meets in a number of large cities, all of which were more or less successful. A feature of the month that has attracted attention, paradoxically, is the fact that ordinary feats of aeroplane experts no longer attract attention sufficient to make them good news items and the daily recording of flights has practically ceased, unless there is some unusual feature.

Cartoon by John T. McCutcheon, in the Chicago Tribune, on the Death of Capt. C. S. Rolls, the English Aviator



Wreck of the Aeroplane Which Fell and Killed Capt. Rolls at Bournemouth, England

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ASCENDED OVER A MILE IN AN AEROPLANE

Walter R. Brookins, although only 21 years of age, has taken a leading place among the aviators of the world. At the Atlantic City meet in July he piloted his biplane, a Wright machine, to a height of 6,175 ft., beating the record of 4,930 ft., established by him at Indianapolis. Brookins has only been actively interested in aviation for about six months. The photograph shows him just before he started the Atlantic City flight.

Some of the best known and most successful devotees of the science have paid the penalty of their devotion to aerial navigation with their lives. On July 12 Capt. Charles S. Rolls, fell when 80 ft. above ground, while conducting tests with a Wright biplane at Bournemouth, England. He had a distinguished record as an aviator, an aeronaut and a motorist. He had made a round trip across the English Channel, between Calais and Dover.

Oscar Erbsloeh and four others were killed by the explosion of the balloon "Erbsloeh" near Cologne, Germany, on July 13. The balloon fell 385 yd. with its five passengers. With Erbsloeh, who won the international balloon race at St. Louis three years ago, were Herr Toello, his financial backer, Messrs. Hett and Kronz, aeronautical engineers, and Motorman Spicke.

On July 15, Daniel Kinet, the Belgian aviator, died of injuries received a few days before in Ghent, Belgium. The rudder failed to work and he plunged to the earth. Kinet held the world's record for flight with one passenger, having remained in the air 2 hours and 51 minutes on May 15.

Charles Wachter was killed at Rheims on July 3 when he fell with an Antoinette monoplane. This aviator had made many important flights and was looked upon as a man of promise.

The most spectacular accident of the month occurred at Barcelona, Spain, where Aviator Ehrmann drove through a thunderstorm and his machine was struck by lightning. The aviator escaped uninjured, although his machine was demolished.

Baroness de la Roche was frightfully injured by a fall from her aeroplane at Rheims, but her life was saved by skillful surgeons. On July 19, the gas works of the Zeppelin Airship Company, at Friederichshafen, Germany, was demolished by an explosion, and seven persons were injured.

The better part of the record-breaking done during the month was by American flyers. Curtiss and Brookins each added to the feats of the air. Brookins surpassed all altitude records by soaring with a Wright biplane to a height of 6,175 ft. at Atlantic City on July 9. Leon Morane, a Frenchman, flew five kilometers in a Blériot in 2 minutes and 43 seconds, at Rheims, July 10. Olieslagers, a Belgian, flew 393 kilometers in 5 hours, 3 minutes and 5 seconds, also at Rheims. Curtiss made a number of spectacular flights over the ocean at Atlantic City, the first of the kind ever attempted in the United States. On one flight, Curtiss made 50 miles in 1 hour, 21 minutes and 5 seconds. Armstrong Drexel, of Philadelphia, carried a reporter of a London newspaper with him in a flight in England on July 19 and the newspaper man declared he could easily have made notes of the fortifications they passed in their route from Bournemouth to Beaulieu, a distance of 35 miles. Drexel also made the record for altitude in England, going to 1,500 ft. on July 11.

The meeting at Rheims early in the month was a most successful affair, although attended by several accidents. Aviators from all parts of Europe were present and a number of new records were set. At Budapest an attempt was made to hold an aviation meet that was not very successful, either financially or for the progress of the science.

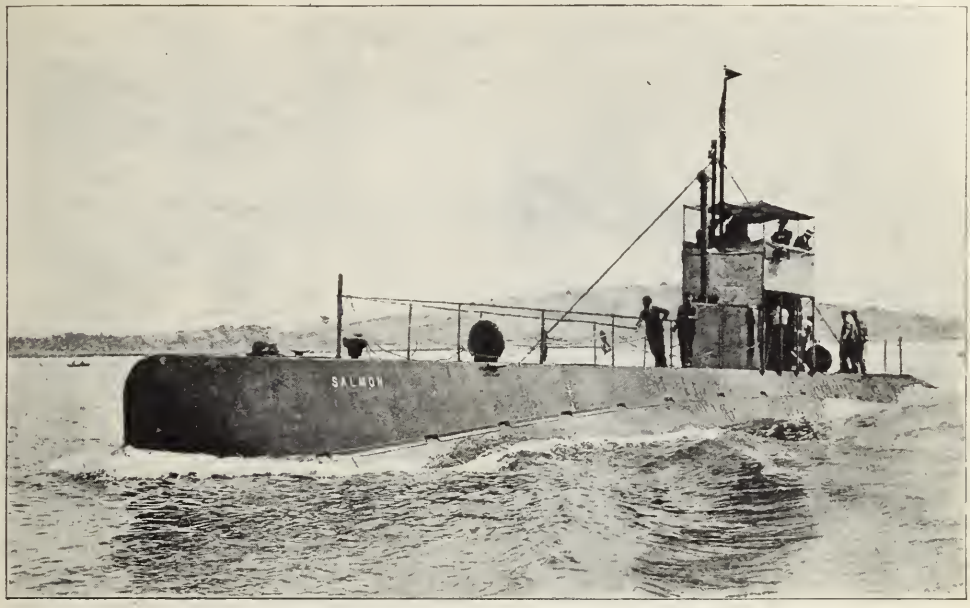
SUBMARINE DISABLES GUNBOAT

During naval maneuvers near Provincetown, Mass., in July, the submarine "Bonita," which was leading an attack on the gunboat "Castine," misjudged the distance after making a dive and, coming up at full speed, crashed against the bottom of her adversary, breaking her plates.

The "Castine" was compelled to run for the shore at full speed so as not to sink in deep water, but the "Bonita" came out of the collision practically uninjured.

¶ During the year ending June 30, 1910, 1,502 merchant vessels of 347,025 gross tons, were built in the United States.

New York City Hall as It Will Appear—Old City Hall in the Foreground



The "Salmon," Most Recent Addition to Uncle Sam's Submarine Fleet

NEW YORK'S MUNICIPAL SKYSCRAPER

New York's new municipal building, now under construction, will be one of the most remarkable structures of its kind, containing many features in both construction and architecture that differentiate it from other public edifices in any part of the world.

In the first place, its architecture is almost monumental in design, so much so, in fact, that, when viewed from the east and at a distance, it will appear more like a colossal memorial pile than like an office building. It is practically U-shaped in plan, the hollow of the U forming a court, open on one side. It is being erected near the terminus of Brooklyn Bridge, on a large plot of land lying between Park Row and Center Street.

The structure will have a frontage of 381 ft. on Center Street, and a total depth of 173 ft. The main portion will rise to a height of 337 ft. above the curbing, and will have 25 floors, while a tower, adding 15 more floors, thus making a total of 40 floors, will give the building a total height of 560 ft. above street level.

SUBMARINE "SALMON" MAKES 1600-MILE OCEAN TRIP

The U. S. S. "Salmon," Uncle Sam's newest submarine, lately completed at the Fore River shipyards at Quincy Point, Mass., is regarded as the most interesting under-water craft in the world. This distinction is due to a remarkable voyage to Bermuda and return which was successfully negotiated by the little cigar-shaped craft. This ocean voyage of 1,600 miles, which consumed 12 days and in the course of which the "Salmon" encountered considerable rough weather, has conclusively demonstrated the seaworthiness of this type of fighting craft.

The round trip to Bermuda, in making which the "Salmon" consumed upward of 6,000 gal. of gasoline, and maintained an average speed of ten knots per hour, is the longest voyage ever undertaken by a submarine of any nation.

The "Salmon," which is 135 ft. long, 14 ft. beam and 320 tons displacement, is the speediest submarine afloat, being capable of a speed of 13½ knots to 14 knots on the surface and 11½ to 12 knots submerged.

ACCIDENT TO OLD-STYLE MONORAIL

The accident on the recently built monorail line running between Bar-

Wrecked Monorail Car

tow and City Island, New York, July 16, in which several of 100 passengers were slightly injured, resulted in fear being expressed by the press of the country that the monorail system is faulty.

The monorail system having the accident, however, must not be confused with the gyroscope type of monorail evolved in the last year or two. Instead, it is a system not very much different from systems that have been tried out and found inadequate for the last 20 or 30 years.

GUN EXPLOSION KILLS ELEVEN

While battle practice was in progress at Fort Monroe, Va., on July 21, a premature explosion blew out the breech-block of one of the 12-in. guns of Battery De Russy, killing 11 men of the coast artillery, and injuring several others, including one officer. The list of deaths would have been larger, it is believed, had it not been for the heroism displayed both by officers and men, wounded included, who stamped out the burning powder and carried sacks of explosive out of the danger zone.

The explosion occurred just after the insertion of the breech-block and before it had been rotated. The safety slide of the firing mechanism, designed to prevent just such catastrophes, broke or failed to "function" properly. In attaching the lanyard with which the gun was to be fired the primer was exploded. This ignited the charge of 200 lb. of smokeless powder in the chamber.

BACK OF AVIATOR AS WRITING SUPPORT

During recent aerial maneuvers of the aeronautic corps of the French army, two of the officers made experiments with several devices designed to facilitate the work of aerial scouts in reconnoitering the position of the enemy.

The most interesting and practical of these devices are shown in the illustration. One of them is a set of trumpets by means of which the officer handling the aeroplane and the officer making a study of the position of the enemy can converse, regardless of the noise of the motor. The other is a roller holder, attached in such a position on the aviator's back that the reconnoitering officer may glance at it at any time or use it for writing purposes.

Devices of French Aerial Scouts

EDITORIAL

THE public, especially the fathers and mothers, will hail with satisfaction the first symptoms of a tendency to return to common sense methods in the public school system of a large city. Chicago is the place, and Mrs. Ella Flagg Young, Superintendent of Schools, is the daring educator who possesses sufficient nerve to take a bold stand for the sane education of children. One of her first orders was that the previous, time-honored system of requiring all pupils to write, or attempt to write, a uniform hand, be abolished. With refreshing practicality, she says, "The business man of today does not care whether the clerk writes the vertical or slant method; what is wanted is a good plain penmanship which can be read." Mrs. Young is absolutely correct, and is evidently not unacquainted with the frequent result of forcing a child to adopt a style of penmanship entirely foreign to its nature, for one's handwriting is far more individual than the shape of the nose, ears or hands. She has also declared, that, in her judgment, the ability of every boy and girl to swim is of quite as great importance as a knowledge of grammar. Hence, provision will be made at once for swimming tanks, in charge of competent instructors, first in all high schools, to which the grammar school pupils will also come, until facilities are provided in every schoolhouse in the city.

If only the school superintendents of the country could get over the practice of each attempting to out-class the others in the variety and amount of work now being done, in our grammar schools especially, and instead teach fewer things of a really practical character, and above all conserve the health of the children, which is most important of all—they would have the united approval of the public. As it is now, the work of any given grade all the way up to last year in high school has been steadily advanced and increased, until, like the present high prices of living, the burden has become almost unbearable. Educators plead they must give more advanced studies or their sixth grade will be no higher than some one else's fifth grade, apparently losing sight entirely of the fact that an overdeveloped brain at the expense of a shattered nervous system can never get very far in the world. A young man or woman, if strong, can largely make up for deficient training after they leave school, but no amount of study in middle life can supply a vigorous constitution, so absolutely essential to large accomplishment in these days. You can teach a man, but you can't supply the missing vitality that nature intended he should build up during the growing period.

One of these days our school system will be radically revised backwards, with more attention paid to producing strong, healthy bodies.

* * *

IN those cities where the Sane Fourth prevailed, and there were a large number of them, the results abundantly justified expectations. It was satisfactorily demonstrated that the new idea celebration, or rather the old idea renewed, was vastly more interesting than mere noise. In many cities, evening fireworks were confined to suitable public places, where large crowds could assemble safely and comfortably, and the firing was performed by details from the city fire department. The greatly reduced death and accident list, as compared with one year ago, leaves no excuse for the passage of necessary ordinances in those cities which have thus far hesitated to take the step.

* * *

COUNT Zeppelin, that grand old prince of the air, deserved better at the hands of fate than the accident which put his passenger ship out of commission after a few flights. The genii of the skies seem marshalled in defense of their domain; their price for victory is life and unremitting effort. In this the history of centuries of conquest on land and sea is being repeated; and as brave adventurers were never wanting to invade the home of savagery, or plunge into jungles filled with unknown dangers and fearful deaths, so these modern knights of the air will fight back, step by step, the obstacles which now guard the frontier of aviation.

To just what extent the passenger airship, now a novelty, may become a practical utility, remains to be seen. At present an airship ride is a startling fad, a thing to do because most people lack the nerve or opportunity to accomplish it. However, an air line with a capacity of twenty passengers each trip is being seriously considered, to sail between London and Paris; and while

the enterprise would involve a first cost of $250,000, there seems every promise of its being a paying venture.

The present year is making aerial history rapidly. In our own country Hamilton's flight from New York to Philadelphia and return; the flight of Curtiss from Albany to New York; the 6,000-foot altitude reached by Brookins; and the proposed and not unlikely continuous flight in October between Chicago and New York, combine to place the work of American aviators in the front rank.

* * *

FOR two weeks some three thousand soldiers of the Army, including infantry, cavalry and artillery, have been camped on the lake front in the heart of Chicago. Each week day a public demonstration was made, witnessed by a million and a half citizens, who were privileged also to walk about the camps. Of the maneuvers too much praise cannot be given, for the work was a revelation to the public. It is a pity that every citizen in our land could not have the same opportunity to acquaint himself with what our Army really is.

While the perfect work of the soldiers awoke feelings of pride and enthusiasm, the no less impressive feature was the quality of the men themselves. The American people are practically unacquainted with their Army. The streets of European cities are filled with the bright uniforms of army and navy, while in our own cities one is seldom seen, even in Washington. The result has been that the people have almost wholly failed to realize the high order of intelligence and ability which characterizes our Army.

The army tournament should be made an annual event, and held in as many of the large cities as possible, in order that the citizens may come to know, and, knowing, to respect and honor our military forces.

* * *

IN this connection it is pleasing to relate an incident during the visit of the American fleet to Australia, as told to me the other day by an American just returned from several years' residence in that country. Before the arrival of our fleet, the general expectation was that the city would be overrun with a horde of wild Indians, and preparations were made accordingly. When the fleet anchored and the men came ashore by hundreds, they proved to be gentlemen, not only the first day, but during the entire week; and the only belligerent incident was when some tipsy Australians made remarks to the native barmaids which the chivalrous Americans thought improper, and promptly knocked the offenders down. Among the lavish entertainers was the proprietor of a leading hotel. He set aside his best parlors as a club for the exclusive use of the American officers and their friends, and provided a lavish supply of the finest viands, wines and cigars for the entire week. His hospitality was accepted and his rooms constantly filled with officers of every rank; but it was the talk of the town for months when the American guests, after each having been served once, thereafter bought and paid for all they consumed. Such self-restraint was something as unheard of as it was surprising. My friend says an American is now a highly respected visitor in Australia, where before they were judged chiefly by the numerous fakirs, whose purpose was to do business on the gold brick order.

* * *

NOTWITHSTANDING the beneficial effects which many receive from a sea voyage, making the slow boats desirable for that reason, there is no doubt that the passenger steamer from this time on will be the large, fast boat. The immunity from rolling and pitching, which is scarcely noticed on a ship like the "Mauretania," where the 20,000-ton and less vessels would experience a rough passage, puts a positive premium on the big boats. Then, aside from those passengers who are naturally poor sailors, are the constantly increasing numbers who cross once or more each year on business, and to whom time and comfort are essential features. For travel, the big ship will eventually supersede the smaller ones, as fast as they are retired, although the cost in weight and fuel consumption makes it unlikely that any substantial lowering of speed is to be expected.

Before vessels of greater length than 1,000 feet can be used, there must be new docks, as present docking facilities, on both sides, have already reached their limit. A thousand-foot ship today would project 150 feet beyond any pier in New York where such a ship could lay.

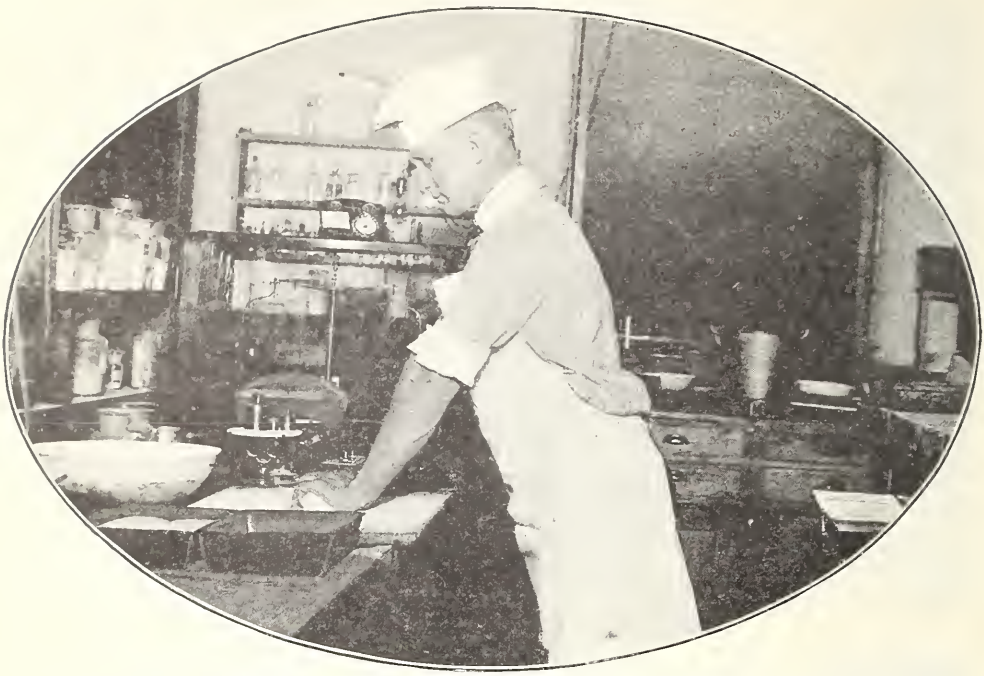
H. H. WINDSOR

Remains of Coach Which Rolled Down Embankment

One of the Day Coaches in Which Nine Persons Were Killed

THE RAILROAD WRECK AT MIDDLETOWN, OHIO

Confusion in the dispatching or understanding of orders was responsible for the wreck of the Big Four Twentieth Century Limited near Middletown, Ohio, on July 4th. The passenger train collided with a freight, and resulted in the death of 23 persons and serious injuries to about 50. All that remained of the day coach, shown in the lower picture, was the floor and one side. The coach shown in the upper view rolled down a 25-foot embankment, and doubled on itself, crushing the passengers within.



H. A. Krohman, a Chemist Working Under an Endowment at the University of Kansas, Who Has Made Several Important Discoveries in Scientific Bread-Making

WELDING THE ALLIANCE BETWEEN CHEMISTRY AND INDUSTRY

By HARRY F. KOHR

THE average man little appreciates how much he owes to chemistry for the fact that the "high cost of living" that he kicks about and blames on the tariff, the gold standard or any other bugaboo isn't as high as it might be. The chemist is becoming an increasingly important factor in our daily life, and his efforts are almost wholly directed toward lowering the cost of production, either by finding more economical processes of manufacture or finding uses for products hitherto considered as waste.

To these ends many of the larger industrial enterprises employ corps of chemists with completely equipped laboratories. Possibly not one discovery of value to that particular business is made in a year or even two years, but when it is made, it is worth to that industry many times the cost of its chemical department.

Profits in industrial enterprises in these days of close competition are largely a matter of economies, and that is where the small manufacturer is placed at a disadvantage. These economies are largely a matter of chemistry, but the cost of fitting out a laboratory and the expense of its operation is so great as to be beyond the means of the average small manufacturer. His business is suffering, perhaps, for the need of just such a department. He knows what the remedy is, but he can't afford the doctor's bill. Or, perhaps, in his business there is a large waste product. He knows there is some value in it, but he doesn't know how to get it out. If he did, perhaps, it would double his profits.

Prof. Robert Kennedy Duncan took those ideas with him when he went, three years ago, to the chemistry department of the University of Kansas.

Shortly afterwards he was discussing with a friend, a laundryman, the ideas he had formed, and the plan he had in mind to establish at the University a department of industrial chemistry for the especial purpose of helping out the small manufacturer with his chemical problems. The laundry business is one of the most highly chemicalized of all industries, yet chemistry can do many more things for it in the way of lessening wear and tear in washing, keeping saw edges off collars, lessening the time required to cleanse clothes, and such things. So Prof. Duncan's friend became the pioneer in the department and endowed a fellowship in the chemistry of laundering with $500 a year. Since then 14 other scholarships have been endowed with sums ranging from $500 to $1,500 a year for the investigation of various chemical problems. So successful has the department proved that the University of Pittsburgh has established a similar one and put Prof. Duncan at the head of it with a large increase in salary.

The rules of the industrial chemistry department of the University of Kansas allow manufacturers or others to endow a fellowship and to have the exclusive use for three years of any process which may be discovered as a result of his endowment. After that the process is made public. The fellow gets a percentage of the profits resulting from the processes he discovers and usually a permanent position with the manufacturer. The fellows, as a rule, are chosen from among the chemistry graduates who show especial aptitude.

For instance, E. L. Tague, a fellow in the department working on an endowment of $500 a year, has just perfected a process for utilizing the constituents of waste buttermilk. He has devised a process for producing casein from buttermilk, something chemists had been unable to do heretofore. At the present time, millions of gallons of buttermilk go to waste every year. Casein is largely used in the sizing of the heavier grades of paper and in solidified form for the making of brushes, combs, billiard balls and many other articles. Exhaustive tests proved the

E. L. Tague, a University of Kansas Investigator, Who Perfected a Process for Utilizing the Constituents of Waste Buttermilk and the Device for Doing the Work

worth of his discovery and now the donor of the fellowship, it is announced, is to build a million-dollar plant from which the discoverer of the process will receive ten per cent of the profits, besides incident emoluments.

At the same time an announcement was made that Archie Weith and Frank Brock, holding jointly a fellowship of $1,300, after working continuously for 18 months, had discovered a process for making an enamel for coating steel containing tanks that has the same coefficient of expansion as the metal itself, meaning that it will not crack under conditions of extreme heat or cold. It will flow over steel evenly and is resistant to acids. The discovery is of the highest value to the manufacturers of steel containing tanks and also for the manufacture of the higher grades of domestic cooking utensils. The fellowship was endowed by a manufacturer in Rochester, N. Y., and from him, in the way of royalties, the young chemists will soon be drawing as much in a month as their fellowship paid in a year.

Two years ago the National Bakers' Association endowed a fellowship paying $500 a year for an investigation into the chemistry of breadmaking. The purpose was to find a means of making bread of uniform quality, to lower, if possible, the cost of production, and to learn everything possible of value to the bakers. Henry Krohman, who was appointed to the fellowship, already has made several discoveries.

Other investigations under way include a search for a new diastase, an investigation into the constituents of crude petroleum, an investigation into the relation between the optical properties of glass and its chemical constitution, the discovery of new uses for Portland cement and of improvements in its manufacture, an attempt to discover new uses for borax, an investigation into the chemical treatment of wood, and an investigation into the possibilities for medicinal use of certain glands of deep-sea mammals.

The investigation into the chemical treatment of wood, in plainer language, is an attempt to break the Japanese monopoly of the production of camphor. The experiments are to determine if it is possible to extract camphor from the leaves and smaller branches of the camphor tree and thus make the tree a producer for years. The practice in Formosa, from which island most of the camphor comes, is to fell the tree and extract the camphor from the wood. Investigation is also to be made into the possibility of growing camphor profitably along the Gulf coast and in the West India Islands.

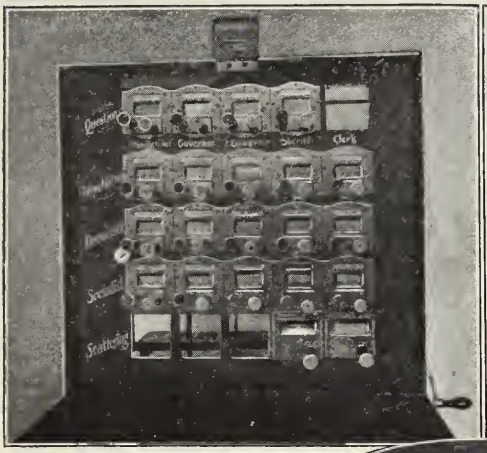
Another scholarship along the same line was founded by a furniture manufacturer for an investigation of the qualities of wood for furniture and methods of preservation.

In nearly all cases it is the desire of the donors of these fellowships that their connection with them be kept secret until their rights to discoveries are fully protected. In other cases there is no need of secrecy, because the scholarship is endowed for the benefit of the world at large. In the case of the investigation into the possibilities of the medicinal use of certain glands of deep-sea mammals, the scholarship was founded through the efforts of Dr. Grenfell, the Labrador missionary-physician, to increase, if possible, the earnings of the natives along the coast of Labrador. Their livelihood depends upon their annual catch of deep-sea mammals, such as walrus and seal. The demand for thyroid glands for medicinal use is so great that, if the glands from seals and walruses are found medicinally valuable, they will add largely to the income of the people in whom Dr. Grenfell is interested.

As yet few small manufacturers have taken advantage of great opportunities afforded them by the industrial chemistry department, largely because it has been looked upon more or less in the light of an experiment. But now, with results beginning to come from it, the University is looking upon it as one of its most important departments, and another step in the general tendency toward bringing the great universities into closer touch with industry.

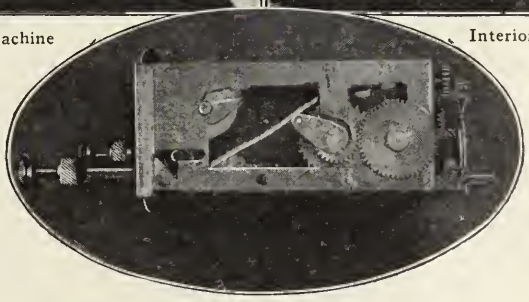
AN IMPROVED VOTING MACHINE

A voting machine that is said to be absolutely accurate in every respect and by which it is impossible for a voter to cast a ballot for more than one candidate for each office, has been invented by a Californian.



The Complete Voting Machine

Interior Mechanism of Machine



Device That Registers and Counts Votes

Beginning at the top of the machine and running in horizontal rows are placed the names of the candidates, each row representing a certain party. The names are so arranged that vertical rows are formed of the candidates for each respective office. To the right of each name is placed a white button marked "yes," and to the left a black button marked "no." The black button is used only when the voter has made a mistake and wishes to cancel his ballot and vote over again. The pushing of the black button will unlock the buttons in front of the names of the other candidates for the same office which were locked by the pushing of the white button, and will cancel the first vote. The cancellation is done by a device which punches a hole through the name of the candidate voted for by mistake.

Back of the names of the candidates and their respective buttons are rolls of tape and the pushing of a white button stamps the name of the candidate it stands for upon it.

If the voter does not find the name of the person he desires to vote for on the machine, he takes a pen and writes the name on a rotary tape placed at the foot of each row of candidates. After writing the name, he presses the white button provided and this drops a metal door over the tape, making it impossible to vote again.

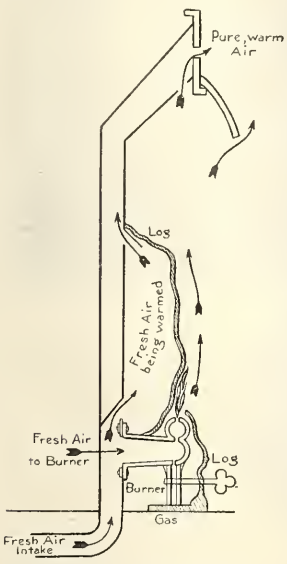
The same principle is involved in voting the straight ticket as in voting for candidates of different parties, but the pressing of the white button for the straight ticket locks every button on the board instead of merely the buttons standing for the candidates for the same office.

A feature of the machine is the fact

that each mechanism for a straight ticket and for each candidate is complete within itself, making it possible to remove any one of them on a moment's notice and replace it with another. At the closing of the polls the clerk in charge has only to unlock the rear of the machine and read the totals for each candidate from the cyclometers.

FRESH-AIR GAS GRATE

A portable gas grate, which takes its air from out of doors, instead of from the room in which it is located, is being placed on the market by a California concern. This is accomplished by means of a fresh-air intake communicating with the air out of doors, and the result is almost perfect combustion without robbing the air in the room of its oxygen.



An idea of the construction of the grate may be gained from the drawing. The waving line above the blaze designates the gas logs. Part of the air drawn in through the intake passes to the burner and comes out around the gas logs as hot air. The other part passes up inside the logs, is warmed, and passes out through a vent near the top of the grate above the logs.

¶A one-wheeled jinrikisha on the monocycle principle is being introduced among the Chinese of the Malay states. It is said to be safe and to have many advantages over the old-fashioned vehicle.

SAN FRANCISCO'S FIRE CISTERNS

An important part of San Francisco's new fire protection system is the series of 100 reinforced concrete cisterns of 7,500-gal. capacity each, built under streets and other favorable places. The cisterns are circular, 32 ft. in diameter and 16 ft. deep, and are made intercommunicating by means of 9-in. mains, also concrete. Besides, each cistern is directly connected with the regular mains.

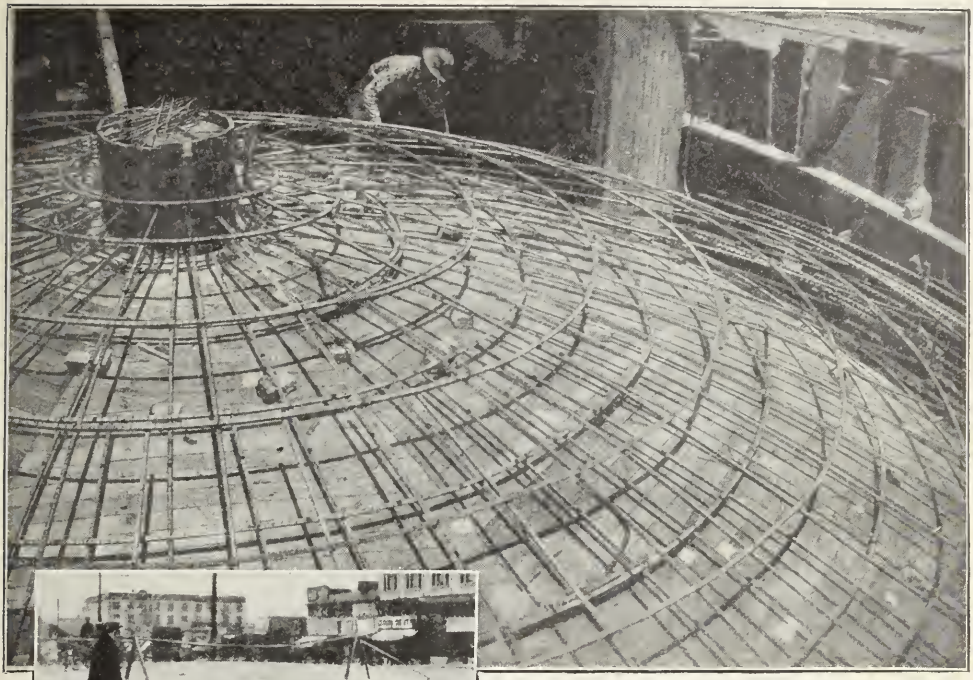
The tops of many of the cisterns, as one illustration shows, form the roadways of streets. The other illustrations show workmen pouring concrete into the forms of the side walls, and the dome shape of one of the cisterns with the steel reinforcing in place.

In the early years of San Francisco's development an emergency water supply was provided in somewhat the same manner. Reports show that in 1870 64 tanks had been built, but in the fire report of 1906 only 18 were mentioned.

A STEAM THAWER

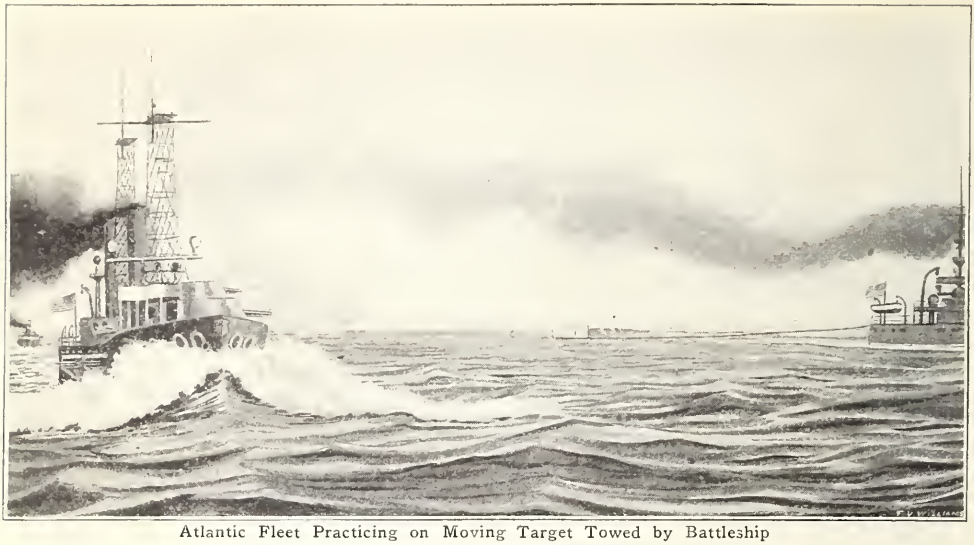
In Alaska it is necessary to thaw the ground before it is possible to dig, at certain seasons, and the miners have been in the habit of building fires in the bottom of their shafts in order to soften the ground. A clever device, which takes the place of the old-fashioned fire, doing the work more rapidly and effectively, is a steam thawer which sends a jet of live steam through a pipe extending down the shaft. At the lower end of this steam pipe a hollow steel point is attached. This is tapped into the ground with a hammer until work with pick and shovel is possible.

An interesting feature of this device is the use of discarded, old-fashioned rifles for that purpose. They are bought up at four or five dollars apiece and the barrels are just right for points, being of good steel, hollow, and only needing to be sharpened at one end to fit them for that purpose.



Dome-Shaped Top with Steel Reinforcing in Place

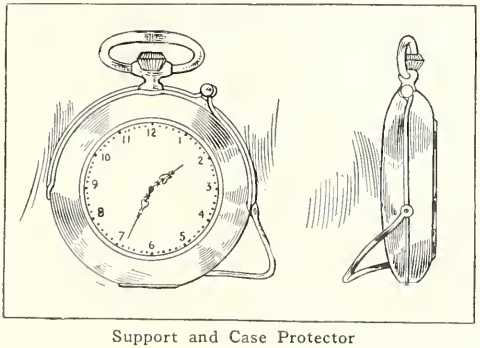
Top of Cistern Forming Part of Street—Building a Fire Cistern in San Francisco Street



Atlantic Fleet Practicing on Moving Target Towed by Battleship

WATCH PROTECTOR AND SUPPORT

In the accompanying drawings is shown a combined watch protector and support. The former is of leather and leaves the dial visible, being of a type already familiar. The metallic support attached to it, however, is something new. It pivots around the two points which fasten it to the leather sack, and



Support and Case Protector

can be so set as to constitute a support when the watch is placed upon a table or other flat surface. When not in use, the support lies closely around the watch case.

¶The American population of Manila has dropped from 5,199 to 4,174, a decrease of 1,025, or about 20 per cent.

DIVISIONAL BATTLE PRACTICE IN THE NAVY

In divisional battle practice in the U. S. Navy the fleet is formed into two divisions, the ships of each steaming in single file. The rear ships of one of the divisions tows a target on which the gunners of the "enemy" train their guns. The drawing depicts such a scene. It was made from a photograph of the Atlantic fleet engaged in battle practice. This fleet has earned high honors for marksmanship, and the practice afforded by firing at such a moving target has been a great aid.

RAIN GAUGE LIGHTENS TASK

A novel device is being used by an employe of the drainage department of the City of New Orleans to save himself unnecessary exertion. Whenever the rainfall is above the normal, he is required to start extra pumps, and when this has occurred at night, it has made a trip to the station necessary. Finding that he was often called when the rainfall was not sufficient to cause his presence at the station, he constructed a rain gauge on the roof of his home.

To a discharge pipe leading from the roof he connected a small drum reservoir, having first calculated to a nicety

the proper size. In this drum he punched a hole, so that if the rainfall is not over a certain amount, the water will run out. If it rains sufficiently hard to require the starting of extra pumps, however, the drum fills, regardless of the hole, and the weight of the water, aided by a system of balance weights, lowers it until it closes the circuit of an electric current. This rings a bell at the side of his bed.

¶A clock that plays soft music, not only to awaken a sleeper, but to put a person to sleep, thus reversing the usual function, and one that turns on the lights in a bedroom, are recent ideas in timepieces.

A COOLING SPRAY FOR HORSES IN HOT WEATHER

The Ohio Humane Society has not contented itself with establishing drinking fountains where horses may quench their thirst on hot days. Going still further, the society has provided a means for cooling the tired and heated animals with a refreshing shower bath. The photograph illustrates a scene in front of the headquarters of the society in Cincinnati. Hundreds of drivers stop there daily and take advantage of the hot weather treatment for their horses. Other fountains and sprayers are being established throughout Ohio cities by the society.

Spray Attachment with Drinking Fountains for Horses

Straw Mats Rolled Up to Admit the Sun

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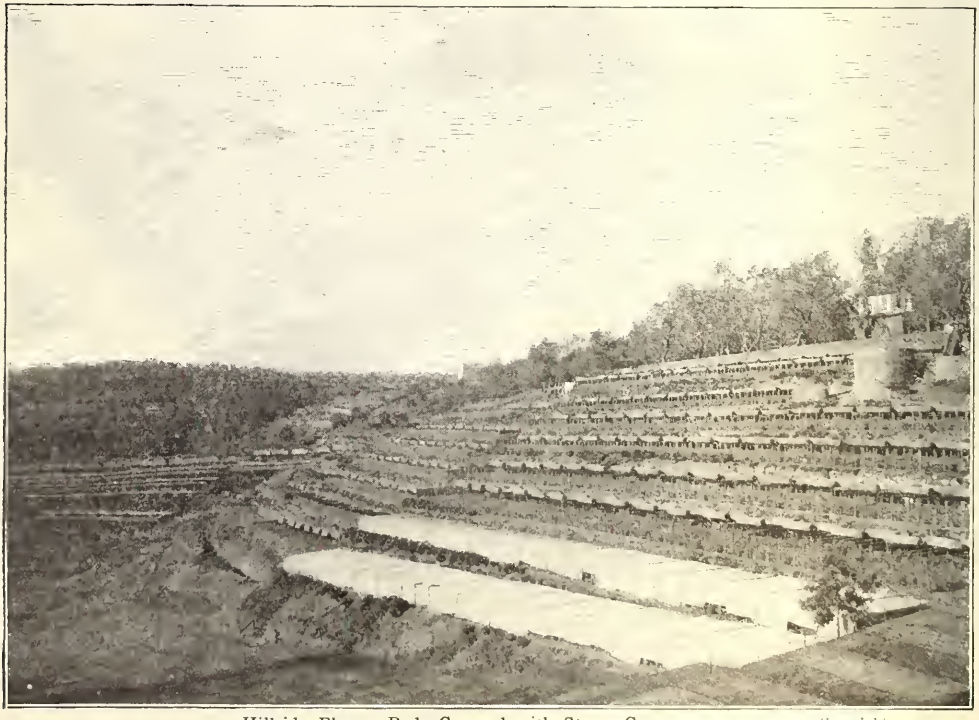

Hillside Flower Beds Covered with Straw Canopy

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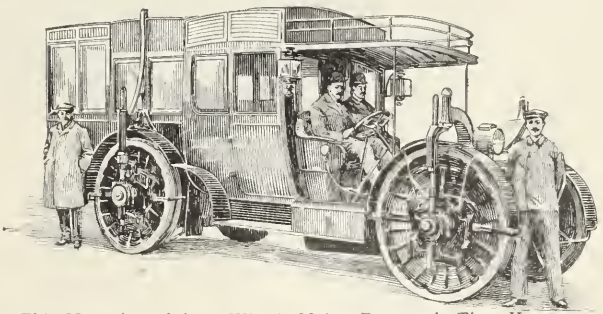
FLOWER GROWING IN THE SOUTH OF FRANCE

The climate in the south of France makes possible the growing of flowers during the winter season, during which time they are generally very rare elsewhere. In the last few years the industry has grown until in the department of Alpes Maritimes alone the annual product is worth from $3,000,000 to $4,000,000.

Near Nice there are many picturesque fields of carnations, which require protection from frosts at night. The method of protection most commonly adopted is shown in the illustrations. A light framework rises above the flowers, and upon these are straw mats, which are rolled up during the day so that the flowers may have the full benefit of the sun's rays. At night the matting is unrolled, thus forming a canopy over the flowers.

COMPOUND SUSPENSION AUTO WHEELS

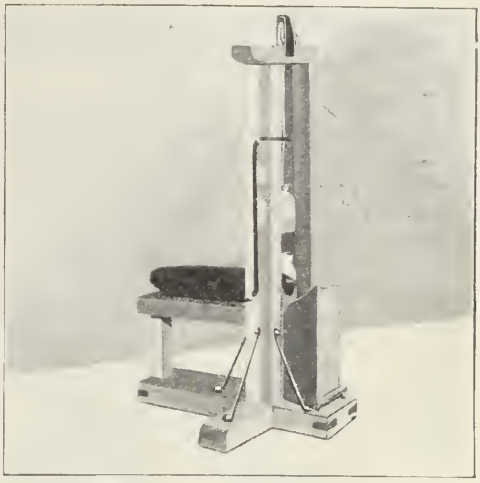
The curious wheels of this heavy saloon-limousine automobile are of the compound suspension type. This suspension makes the use of pneumatic tires unnecessary. The covering of the wheels is a highly-compressed leather. The vehicle carries 23 people, and was recently presented to a Chinese military delegation in Paris. It made a journey from Brussels to Paris without accident, and demonstrated on several rather rough roads an absence of jar and vibration that was commendable.



This Mounting of Auto Wheels Makes Pneumatic Tires Unnecessary

GUILLOTINE-SHAPED CIGAR-CUTTER

A curiously shaped and operated cigar-cutter is shown in this illustration. It is an exact reproduction in miniature of the famous guillotine of the French revolution, and will have to cut off the ends of many cigars before it equals the horrible record in heads of the instrument of which it is a copy.



Cigar-Cutter Copied After Guillotine

The knife of the cigar-guillotine is raised by pulling on the string, and falls when the string is released.

¶A compilation of the comparative risks in different trades made by the German Government does not agree with the opinion which has been prevalent that the miner is more exposed to danger than the worker in any other occupation. From the German report it would seem that the carters and drivers follow the most hazardous occupation; next in order being quarrymen, canal and river boat-men, miners, tunnel workers, wood workers and iron and steel workers.

COLUMBIA UNIVERSITY'S SPHERICAL SUNDIAL

By FOSTER WARE

Columbia University lays claim to the ownership of the only spherical sundial in the world. It is a ball, 7 ft. in diameter, and its shadow, falling upon a flat granite plinth, travels around the base and tells the time of day.

Prof. Harold Jacoby, head of Columbia's astronomical department, has designed it so as to indicate standard New York time, not solar time as is ordinarily shown by sundials. These two kinds of time, of course, usually disagree, sometimes by a considerable fraction of an hour. Prof. Jacoby's work consisted chiefly of calculating the angle of the ball's shadow at noon for every day in the year.

With the sun shining, the big sphere casts an elliptical shadow, which travels around the base as the hours pass. It would be possible, of course, to add to the number of hour marks so that the dial would indicate time all day long, and this may be done when the necessary calculations have been completed. For the present, however, a series of 12 concentric circles—one for each month in the year—have been engraved upon a bronze plate inlaid on the surface of the base.

On each line are marks numbered to represent each day in the month. When the shadow intercepts a given line at one of these marks, it will be 12 o'clock noon of that particular day. The position of the shadow at noon is different every day of the year, so that it will touch a given mark—say August 1—only once a year at noon.

Prof. Jacoby has calculated the angles astronomically and believes that the dial will mark the noon hour to the exactness of a fraction of a minute. It is his opinion that, as the dial is more of an ornament and a curiosity than anything else, it will attract more attention and create more interest than a complete dial because the transit of the shadow each day at noon will bring together a considerable number of students and others to watch the phenomenon.

The dial was recently presented to the university by the class of 1885, of which Prof. Jacoby is a member, as its quarter-centennial gift. It was erected at a cost of $10,000, and occupies a prominent place on the Columbia campus. The ball, which is made of polished green Ascutney granite, rests upon a broad flat granite base of neutral color. This base is 24 sided, and is decorated with inlaid bronze ornaments, designed by the firm of McKim, Mead & White, architects of the Columbia campus buildings. Many of the ornaments are taken from the signs of the Zodiac.

CATCHING FISH BY POISONING

Fishing with poisons is practiced by primitive peoples in many different parts of the world, but in all cases the methods have a common resemblance in that they all involve the temporary stupefying of the fish.

The poison consists of the juices of crushed plants, different kinds being used in different countries. The plant, of whatever species is available, is gathered and crushed in great quantities, the gathering and preparing requiring the combined efforts of many persons. Whenever a fish-poisoning occurs, it is the occasion of a general picnic, with feasting, the wearing of flowers, and much jollity. This is especially so in the South Sea Islands.

When the tide recedes from the reefs, many deep pools remain, filled with fishes of many kinds. The poison is placed in these pools and later the fish come to the surface in such distress that they can easily be picked up. Fish coming in across the reefs with the rising tide are also affected by the poison and are easily secured.

Although the juices used are poisonous to the human stomach, there is said to be no unwholesomeness attached to the eating of the fish so captured.

HANDSOME SUNDIAL WHICH GIVES STANDARD TIME

ARTIFICIALLY COLORED TUBEROSES

Reports received in this country recently to the effect that florists of Tientsin, China, were growing tuberoses of a red color has resulted in an investigation by S. S. Knabenshue, U. S. Consul-General, which has brought to light a very interesting means of artificial coloring.

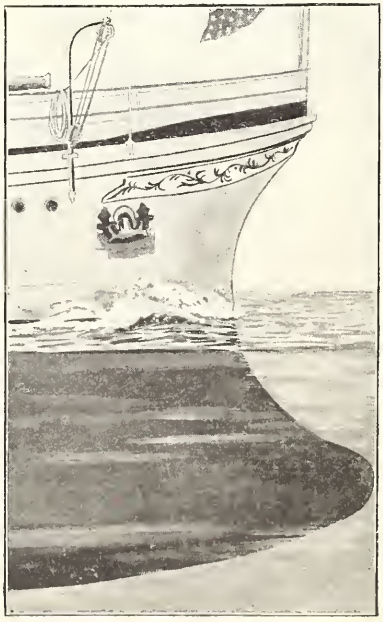
None of the red tuberoses are natural, the color being obtained by two different methods, both of which are more or less simple. The first method is as follows: When the tuberose of the ordinary white variety is near the flowering stage, the flower stalks are cut off close to the ground and are placed in water in which is dissolved a red earth. This coloring matter is drawn up into the flowers, tinting them red, the first that appear being slightly tinged, while those opening later have a more pronounced color.

In the second method the bulbs themselves are doctored. Incisions are made in the lower half of the bulb, then it is placed in the ordinary flowerpot. The opening in the bottom of the pot is closed with a cork; earth, mixed to a mud with water in which the coloring matter has been dissolved, is placed in the lower part and uncolored earth is placed above this to hide the coloring matter. The resulting flowers have the tint of the coloring used.

NEW TYPE OF BRITISH CRUISER BOWS

Rams as powerful as any carried by warships of past days are to form the lower part of the bows of some of the new British third-class cruisers, while that portion above water will be concave and graceful in appearance, belying the formidable character of what is hidden by the water. The illustrations show what the bows will look like, both above and below the surface of the sea.

Appearance of a Warship's Ram



Combination of Ram and Concave Bow

Concave Bows of New British Cruisers

The ram of a battleship is an effective weapon for use in running down an attacking fleet of torpedo boats.

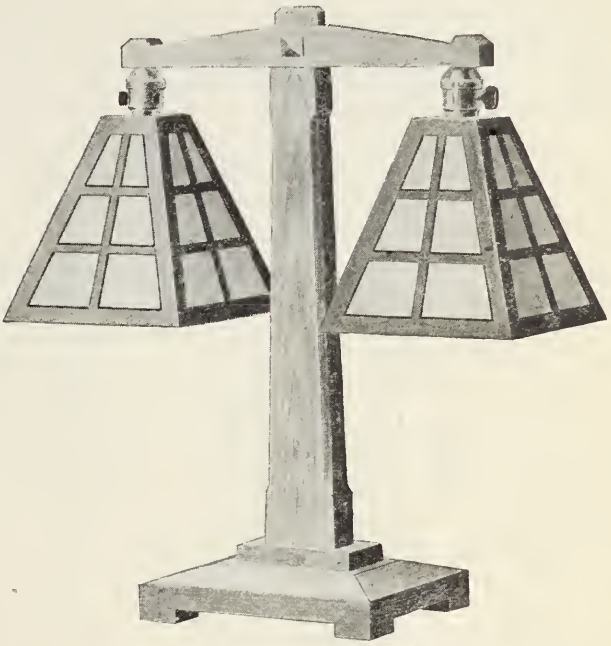
THE MAKING OF ARTS-CRAFTS LAMPS

By JOHN D. ADAMS

Part II

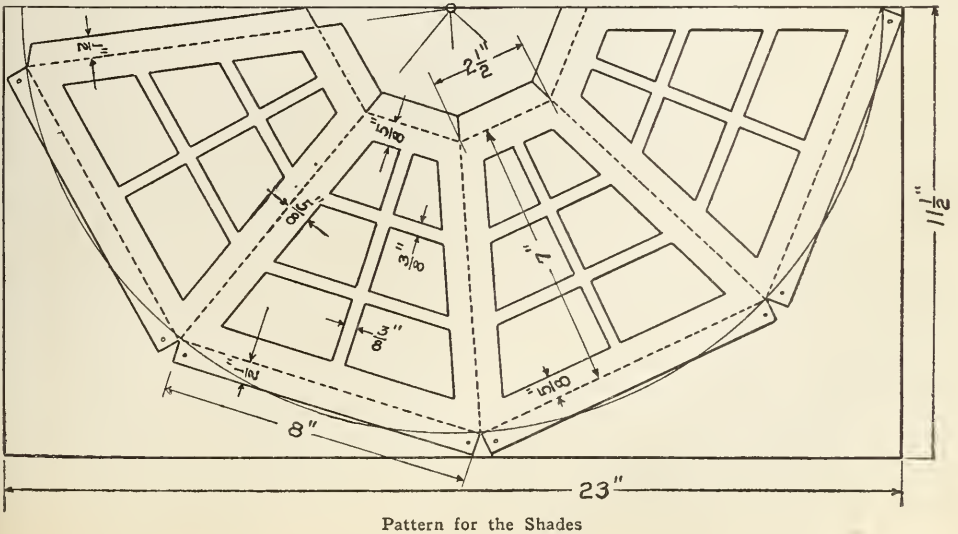
TWO-LIGHT PORTABLE LAMP

IN this two-light portable lamp we have an excellent design for the center of the library table. The shades are deep and the lamp is hung well up, so that anyone writing, drawing, or doing any sort of work requiring the use of a table, will find that the light is thrown just where it is required, while the eyes are completely shaded. The shades are of a much used pattern, and those that do not care to undertake the construction of the stand will find them very useful in hiding the common unshaded and glaring drop lights, so harmful to the eyes.



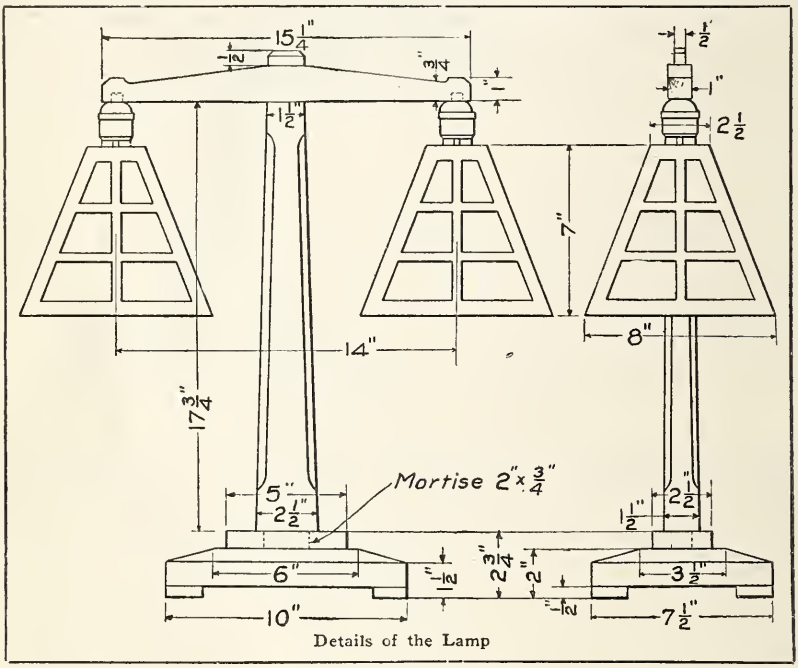
Attractive Two-Light Library Table Lamp

The shades are constructed in the same general manner as the one described in the previous chapter. Procure a piece of tough cardboard about 12 by 24 in. Lay out the pattern for one side with a sharp pencil on a piece of thick paper, and then cut it out with a sharp knife. Apply the paper pattern to the cardboard and mark it off, then move it one space and mark off



Pattern for the Shades

again, continuing the operation until all four sides are drawn out as shown. It will be noted that the last edge has an extra strip, which is for the purpose of connecting the first and last sections together. There are also extra strips along the top and bottom of each section. The dotted lines indicate those that are to be merely scored with the knife for bending, and the full lines are those that are to be cut clear through. When ready to bend into square of cardboard closely fitted into the top from underneath. In the center of this square cut a hole 1⅝ in. in diameter, and near each corner push the knife blade clear through. Cut out four strips of tin, measuring ¼ by 1½ in., and fasten them to the top through the slits made with the knife, in the manner shown in the detail view. All this is for the purpose of connecting the shade to the existing socket, which should now be placed in position and

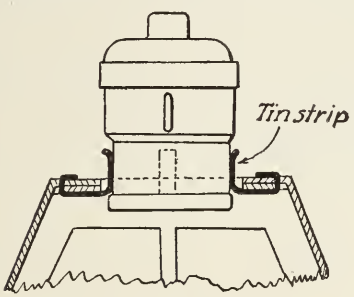


Details of the Lamp

shape, place the line of each bend over the sharp edge of a table, hold the portion on the table down with a piece of wood, and then gradually bend along the entire line. The two ends may be fastened with paper fasteners or by glue, in which case means should be provided to keep the connection tight for an hour or so until set. Bind the corner edges of all bends with passepartout tape. The extra strips on the lower edges should now be bent inward and connected at the overlapping corners with paper fasteners. The extra strips at the top are then to be bent inward and fastened to a the four strips of tin fitted closely around it, and when the shade is ready to be hung up for good, bind tightly with a piece of light cord. It only remains now to place the colored paper on the inside. As the effect when illuminated cannot be judged by daylight, the paper should be tried after dark, and if it proves too light use two or more thicknesses.

Start the construction of the stand with the base, which, after having been trimmed off squarely and bevelled on top, should be fitted on the under side with a little block at each corner. The second base block should now be

squared up and an oblong mortise cut for the end of the center post. Glue this block in position, and then proceed with the cross bar at the top. Shape this up to size, and then cut an oblong mortise in the center, after which the center post should be prepared. After planing up to the proper taper, make a tenon at each end to fit the mortises already made in the base and top bar. Before putting these three pieces together, provision should be made for the wires. The simplest way is to pass the cord from each light directly through the end of the top bar and connect them together so as to form a Y with a single cord running to the source of supply. The better way is, of course, to entirely conceal the wires and have the cord leave the lamp from underneath the base. This method necessitates the boring of rather long

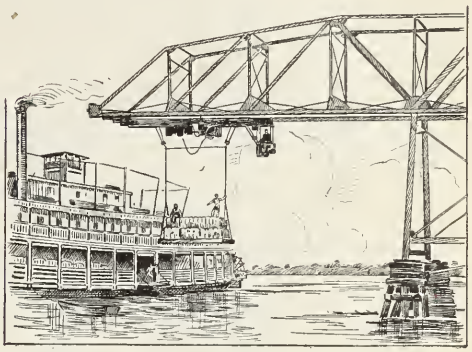


Method of attaching Shade to Socket.

holes, a matter which, in the absence of the necessary tools, can be readily disposed of at the nearest electrical shop.

BOAT AND RAIL CONNECTION ON THE MISSISSIPPI

A steel construction work, known as a "telpher" has been erected on the bank of the Mississippi, about three miles downstream from Memphis, Tenn., by a railroad company, to facilitate the transfer of freight between boats and cars. Planters, remote from railroad facilities and convenient to the river, ship their products by boat to the telpher, where it is transferred to cars. This is one of the many plans to solve the problem of landings and freight transfer on the river.


Telpher Transfer System on the Mississippi

The connection consists of a loading-platform on shore with the telpher system, ending in a cantilever truss over the river. A 30-ft. barge is used at present as a loading platform under the truss, but the telpher will probably be used before long to unload direct from the river boats.

INSTRUMENT FOR RAPID LARDING OF MEATS

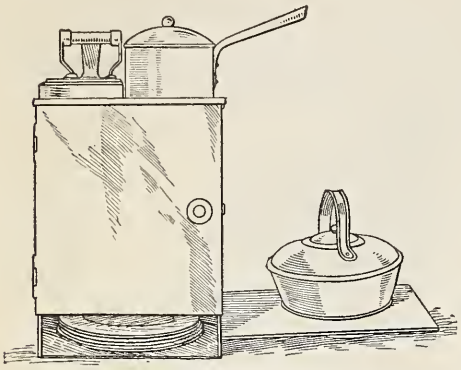
This illustration shows a butcher's tool for the rapid larding of meats. It consists of two parallel sections, one of which carries the piercing point, while the other carries the handle. The lardons, which are strips cut from flank-fats, brisket-fats, fat ends of bacon, etc., are placed in the hollow formed between the two sections. If they are long pieces, one end hangs down just forward of the handle. The tool, with the lardon in place, is forced through the meat until the point pro-

The Rapid Larder

trudes. The user pulls one section out by the handle, and the other out the other way by taking hold of the point-head, which is provided with corrugations enabling the user to get a firm grip upon it to pull it out.

INEXPENSIVE ELECTRIC COOKER

This electric cooker consists of an oven, 12 by 12 by 14 in. inside, with

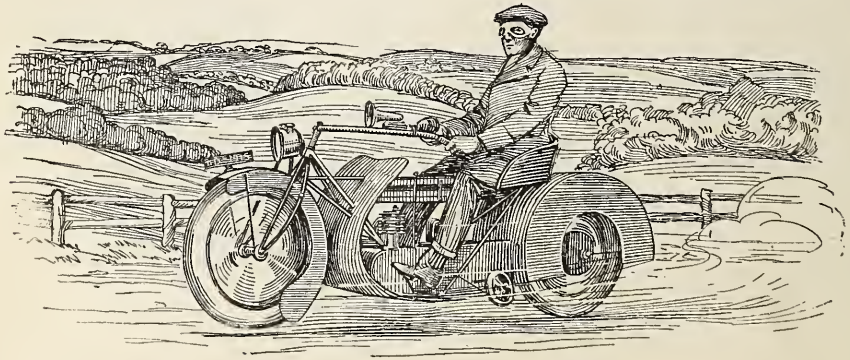


Economical Electric Cooker

the heating apparatus mounted on one side. This is carried on hinges so that it can be lowered, as shown in the illustration, for boiling, frying, etc., while in its ordinary position it heats the oven. Thus one heater can be made to do the work of two, although, of course, not at the same time.

THE MOTORCYCLE OF 1912

The change in motorcycle construction in Europe this year points to more radical changes in the coming years, and the final discarding of all types of machines with pedals and saddle seats. This illustration is a forecast of the machine of 1912, with duplex frame and mud-shield to protect the rider from mud and wind, roller wheels to prevent side-slipping, a bucket seat in place of the customary saddle, and an engine started by a crank mechanism instead of by pedals. The feet of the rider find a rest on the lower part of the mud-shield which extends down from in front of the rider and meets the shield that covers the rear wheel.



A Conception of the Coming Motorcycle

THE CHILLING OF BEEF FOR LONG SHIPMENTS

It is expected that the steadily increasing meat exportation from Australia to England will be even more rapidly increased through a process of chilling the beef. The initial shipment was 62 days in transit, but was received in excellent condition and brought prices equal to the best Argentine beef, though the time in transit was twice as long.

The process for chilling, as distinguished from freezing, beef, is the invention of a packer who has had a long experience in the trade both in Australia and the Argentine. After killing, the carcass is prepared and cleaned with all possible haste, and the sides and quarters are hung up in an insulated chamber, with plenty of air space between them, the chamber having been perfectly sterilized by both chemical and mechanical means. When the chamber has been filled, the contents are subjected to sterilization by a powerful germicide. The temperature in the chamber is then gradually lowered

to 32 deg. F., where it is maintained until the beef is placed on board ship.

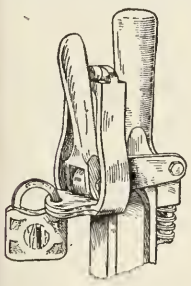
The beef, in cooling, gives off a certain amount of moisture. This is extracted, and the air is kept in a relatively dry state. The ship's hold must be similarly sterilized and prepared for the reception of the beef, and on arrival in London the beef is placed in chambers subjected to the same process. All the beef must be carried suspended to hanging rails, and in the ship's hold there must be apparatus for sterilizing the air and extracting the moisture.

In the first shipment from Australia to London the hold of the ship was prepared for the beef by reducing its temperature within 48 hours to 30.5 deg. F., which temperature was maintained throughout the voyage, except twice, when the hold was opened for examination.

An advantage the chilled beef has over frozen beef is that it "ripens" during its ocean voyage, and arrives ready for the table, while the frozen beef arrives in practically the same state as when it was killed, too fresh to be eaten.

LOCK PREVENTS TAMPERING WITH AUTOS

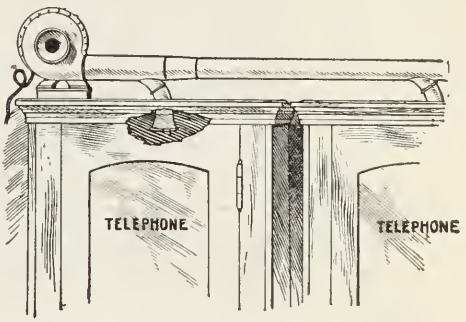
Many automobile accidents occur because someone, in a spirit of mischief or otherwise inclined, changes the positions of the operating levers when the car is standing still, thus bringing into action when the machine is started a gear which the driver thinks is thrown off.



Such accidents are made impossible by this new auto lock, which consists of a metal loop placed over the operating handle in such a way as to prevent the working of the latch. The metal loop is locked in place with a padlock.

VENTILATING APPARATUS FOR TELEPHONE BOOTHS

Fresh air at the rate of 50 cu. ft. per minute is blown into one or more telephone booths by this ventilating apparatus. It consists of a small inclosed fan, driven by an electric motor, and mounted on the top of one of the booths. The fresh air drawn into the fan is driven into the booths through tubes and diffused in a manner which makes the flow of air positive but gentle.



Fresh Air Apparatus for Telephone Booths

A feature of the installation is a device through which the air forced into the booths escapes. This device breaks up the sound waves, so that no sounds pass from the booths, thus insuring privacy.

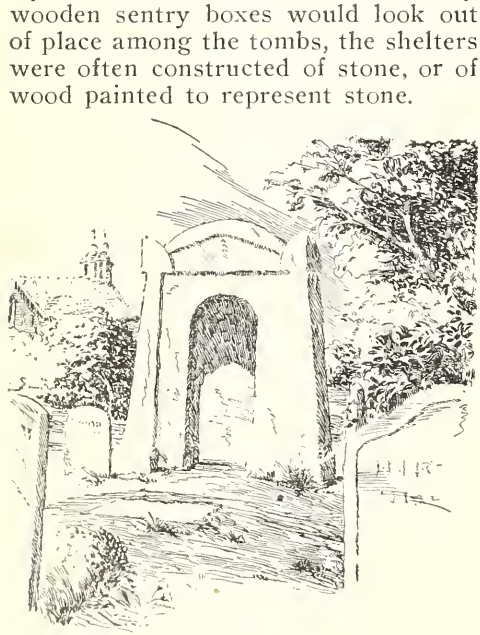
STRENGTH OF NEW ALLOYS

Recent experiments with new alloys of copper, aluminum, and manganese show remarkable peculiarities. An alloy of 88 per cent copper, 9.99 per cent aluminum and 1.01 per cent manganese showed an enormous tensile strength, a cold-drawn bar having a yielding point of 40.88 tons per square inch and an ultimate stress of 52.08 tons per square inch. Another alloy proved to be so hard that it could take a cutting edge sharp enough to sharpen a lead pencil.

The British Admiralty has been experimenting with these alloys to determine their resistance to corrosion in salt water.

A GRAVEYARD SENTRY BOX

During the time, some hundred years ago, when body snatching was very common in the English cemeteries it became necessary to keep a sentry on duty at night. Some kind of shelter was required to protect the sentry from the weather, and, as ordinary wooden sentry boxes would look out of place among the tombs, the shelters were often constructed of stone, or of wood painted to represent stone.

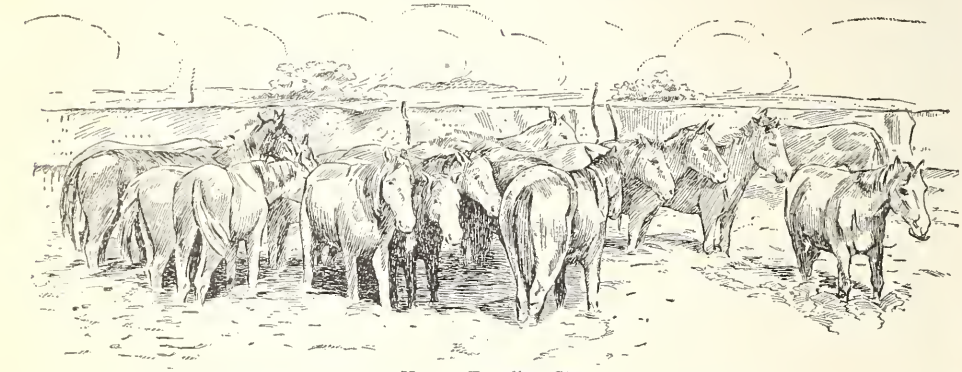


Shelter for Graveyard Guard

The central piece in this illustration, which looks like the entrance to a vault, is a fine example. It still stands in St. Mary's churchyard at Wanstead, Essex.

HORSES MIX CLAY FOR BRICK

Horses play an important part in the mixing of clay for brick in the Argentine Republic, their feet doing the work that is done by machinery in the brick-making plants of the United States. The Argentine Republic is a country in which large quantities of brick are used, but nearly all of it is the "dobe" or sun-dried kind, and these find their way into building operations of all kinds. Such bricks usually receive an outer coat of plaster after being put in place.



Horses Treading Clay

The illustration shows horses at work in one of the brickyards just outside Buenos Aires. After a quantity of clay is placed in the inclosure, the water is turned on and the horses turned in. A boy with a long whip keeps the animals moving until the clay is mixed to the proper consistency.

ELECTRICAL FERTILIZATION OF SOIL

The average person probably believes that the impulse given to the growth of plants by a thunder storm is due altogether to the water the clouds discharge. Yet, according to Lionel Lodge, brother of the great English scientist, it is the electricity rather than the water that provides the remarkable impulse, and it is just such an effect that is now being artificially produced in the electrifying of crops.

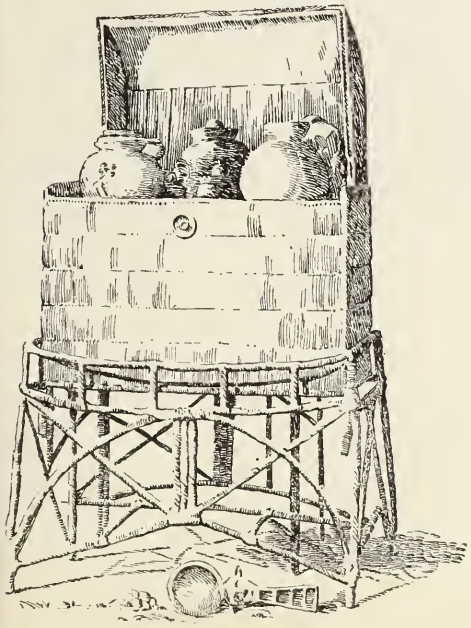
A year or so ago Sir Oliver Lodge advocated the use of electricity for reinforcing the fertility of soils, and since then the work has been carried on until now it has been taken up as a practical auxiliary of farming, both in England and on the continent.

The electric current required can be generated with dynamo or procured from the nearest supply company's circuit, and by means of a converter raised to about 100,000 volts. The field network consists of fine iron wire, the wires being spread about 30 ft. apart and about 18 ft. above the ground. The wires used are so fine as to be almost invisible, even when standing immediately below them.

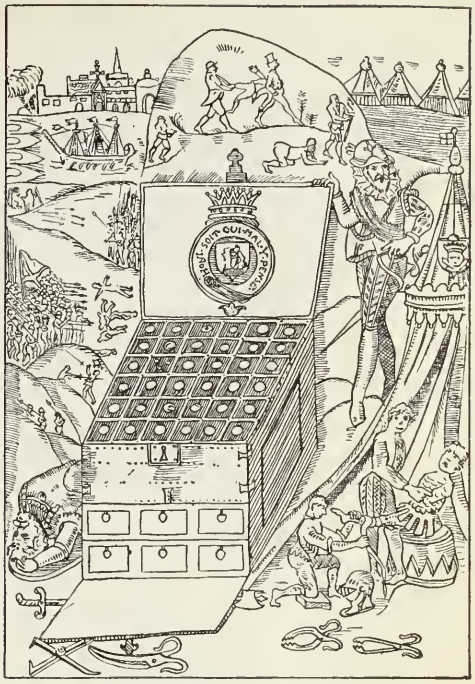
With average soil the electrified area may be expected to yield 30 per cent more than a non-electrified area.

ANCIENT MEDICINE CHESTS

Both the medicine chests shown in these illustrations are designated as ancient, but one of them is more than 3,500 years older than the other. The very ancient one, which belonged to Queen Mentu-Hotep, was used about 2,200 B.C., and is therefore 4,110 years old. It was discovered at Thebes. The material of the chest is plaited papyrus reeds, and it is divided into six compartments, each containing a beautifully shaped medicine jar of Oriental alabaster. Various medicinal roots, and a wooden spoon were also discovered in it. The chest seen in the illustration was transported from place to place in a massive outer case made of wood, and decorated with hieroglyphics.



Medicine Chest of Ancient Egypt



Army Medicine Chest of 1588

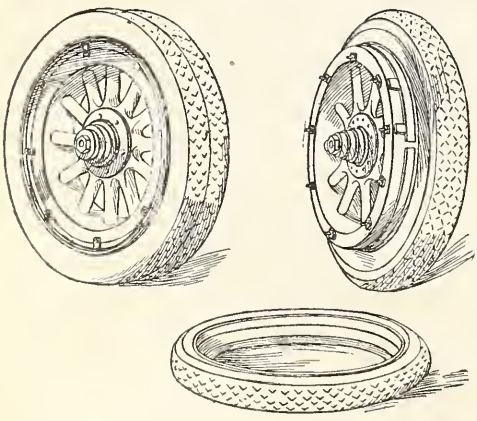
The other chest shown was probably used by William Clowes, a famous army surgeon of the sixteenth century. It is an enormous affair, provided with more than 300 varieties of medicines, some of which contained as many as 64 ingredients.

¶Sir William White, the eminent naval constructor, who designed the big Cunarder, "Mauretania," declared recently that the only limit to the size and speed of steamships is the item of cost.

DUAL PNEUMATIC TIRES FOR AUTO FIRE APPARATUS

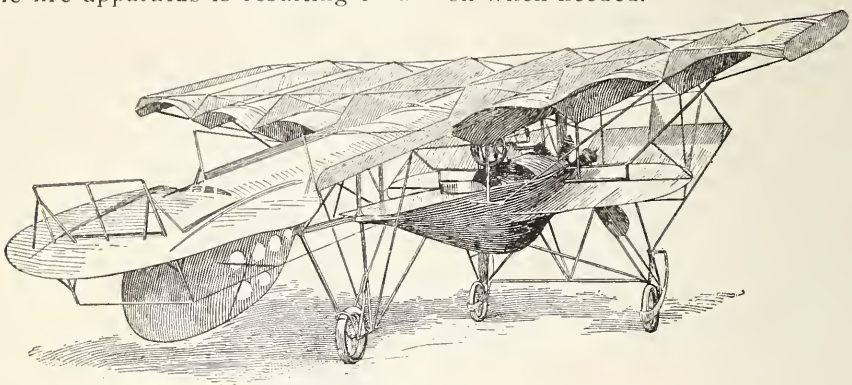
The steadily increasing use of automobile fire apparatus is resulting in a search for a tire that will be reliable and yet at the same time provide a fair amount of resilience. The ever present possibility of puncture or blowout makes the ordinary pneumatic tire somewhat dangerous, but a dual tire with demountable rims has now been designed and is said to do away with most objections.

The dual feature consists of two pneumatic tires mounted side by side. An injury to one tire is unlikely to affect the other, it is claimed, as the load can be carried on the good tire until an opportunity for substituting a new tire for the injured one occurs.



Both Tires in Place—One Tire Removed

To remove one of the tires it is necessary to loosen eight nuts and slip the demountable rim off. Substitute tires may be already blown up, ready to slip on when needed.



No Wood or Canvas Used in This Flying-Machine

STEEL-ALUMINUM AEROPLANE

An aeroplane made entirely of steel and aluminum, and provided with a surface under the driver's seat which is expected to cause the machine to float if it falls into the water, has been built and successfully tested out by an American living in Paris. The builder is a Mr. Moisant, who has made a number of short flights in it.

The wings are made of thin aluminum, and the lower parts are of steel. The driver's seat and the motor are placed on a surface or car built to float on the water and provided with two flat stabilizers, one on each side.

THE FRENCH RAILROAD INTO CHINA

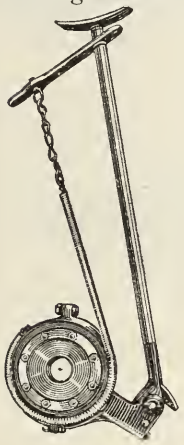
The completion of the French railroad from Tonkin, French Indo-China, to the ancient Chinese city of Yunnanfu, over 500 miles beyond the mountain ranges, makes an artery of steel from the coast to the dark interior. In some districts the road has cost over $30,000 a mile to build, while an average of $25,000 a mile is a conservative estimate of the amount expended.

The railroad, according to the Pall

Mall Gazette, is a magnificent tribute to the French engineers who have battled with all known difficulties and a few more added. It pushes out through the paddy fields near Hanoi, demanding the building of no less than 175 bridges, one for almost every mile, through the broken land of Laokai, then shoots northward, now following the river's course, now across unhealthy marsh, dodging a 6,000-ft. mountain, and losing itself in the deep gorge beyond. So it continues, over dozens more bridges, around more mountains, down into more gorges, to Yunnan-fu.

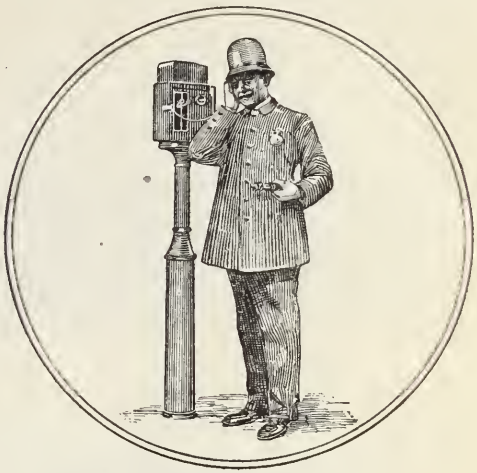
PEDAL STARTER FOR AUTO ENGINES

An interesting device for starting the engine of an automobile without leaving the seat, and without requiring the use of the hands, is shown in this illustration. It is known as the pedal starter, and consists of ratchet-wheel fixed to the clutch shaft of the car and operated through a pawl by a pedal under the driver's foot. By pressing on this pedal the shaft is revolved and the engine set in motion.



ROCHESTER'S NEW POLICE TELEPHONE SYSTEM

Rochester, N. Y., has a new police telephone system which is to be supplementary to the ordinary patrol box system, and by which calls are handled through the switchboard of the regular telephone company. The telephones are ironclad and mounted on iron pedestals located on street corners. Each telephone set is equipped with loud-ringing gongs, rung by the "central" operator, so that the patrolmen may be called while traveling their beats, as well as being able to call up headquarters themselves.



Police Telephone Box in Rochester, N. Y.

"LITHOGRAPHIC" PLATES OF NICKEL

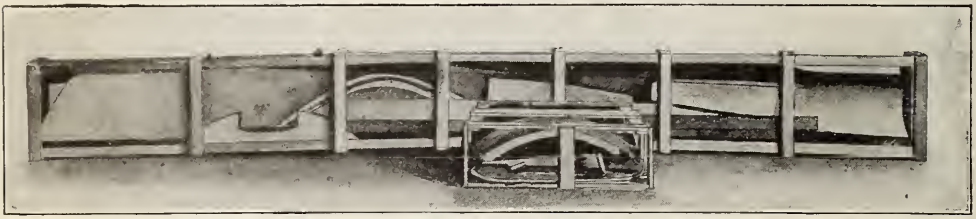
A new German process allows of the use of electro-deposited nickel plates in place of the very fine grain stone now imported from Germany for the printing method called lithography. A brass slate or one of some other metal, scoured so as to allow the ink to take to it readily, is coated with graphite or other material. A thin coating of nickel is then given this by electro-deposition, after which a heavy zinc deposit is put on and the two deposits stripped from the brass or other metal plate. The nickel is then left with a surface immediately available for lithographing, and is used in place of the lithographing stone.

This stone is now in almost universal use. It is a variety of limestone, and owing to its cost and weight in large sizes a substitute has been sought for a long time.

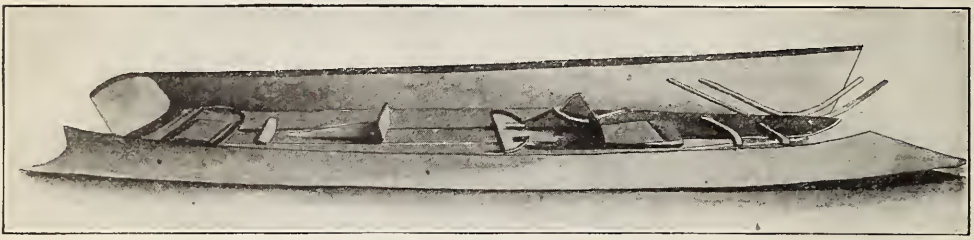
¶The total of building contracts recorded in San Francisco since the earthquake and fire amounts to $163,010,438.

KNOCKDOWN METAL MOTORBOATS

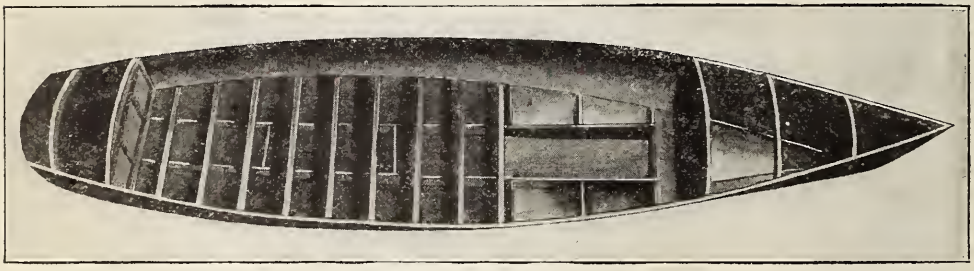
Knockdown motorboats of wood have been on the market several years, but these illustrations show the knockdown principle as adapted to steel motorboats. The first shows the complete hull crated for shipment; the second, the hull ready to assemble; the third, everything in position but the deck, flooring, and seats, which are of wood; and the fourth, a side view of the hull.



Crated for Shipment



Unpacked and Ready to Assemble



Interior View Without Decking

Side View Without Decking

INGENIOUS SYSTEM OF APPOINTMENT BOXES

An automatic appointment box system which may be installed in various places, such as hotels and railroad stations, so that the public, by the expenditure of a small sum may leave and receive a message has been devised by some bright minds. The working of the box is best explained in the following manner:

Brown has an appointment to meet Green at the appointment box at the

railroad station at 6 o'clock. A half hour before comes a telephone message from a client of Brown's making an appointment at the city hall, also at 6 o'clock. The latter engagement is an important one from a business point of view, while that with Green is merely personal. Brown, therefore, on his way to the city hall stops at the railroad station and leaves a message in the appointment box, making a further appointment with Green for, say, 7 o'clock. Green arrives at 6 o'clock and, failing to see Brown, drops a coin into the box, after which he turns a handle and sees Brown's note.

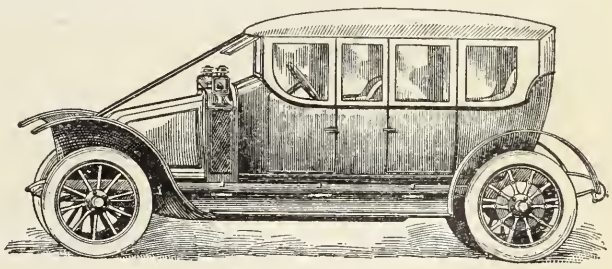
In the top of the box are two metal lids. In the first of these one inserts a coin, and, lifting the lid, finds a celluloid pad on which the message is written. The second lid, on the insertion of a coin by the person expecting to find a message, shows the message protected by a glass cover, and thus rendered immune from erasure or alteration. By means of a handle the roll of celluloid may be wound back, until any of a number of messages wound upon it can be seen, but in this unrolling it does not pass under the first lid, consequently cannot be touched. On releasing the handle, the roll is automatically rewound, until a blank space is available for the next person who wishes to leave a message.

The messages can, of course, be read by anyone placing a coin in the box, but with ordinary appointments this need not matter.

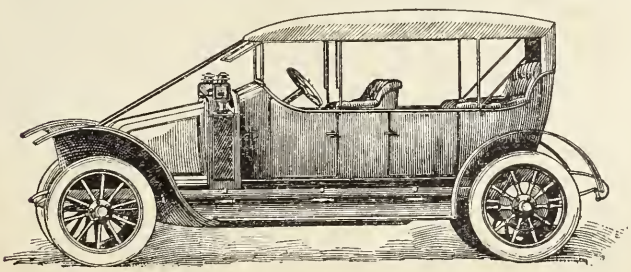
¶A solid train of 21 cars of cartridges and shells, approximating 750,000 lb. in weight, which was shipped recently from an Ohio ammunition factory, is said to be the largest single shipment of the kind ever made.

QUICKLY DETACHABLE LIMOUSINE

A French automobile manufacturer has brought out a new adaptation of the torpedo body, making the addition of a limousine a simple matter. The torpedo body is not radically different from the types seen in the United States. In nearly every instance the purchaser of the car finds it to his advantage to buy the detachable limousine also, because of the comparatively small additional cost. The upper part can be put on in a few minutes, and the fair weather car is made very comfortable for winter use.



Torpedo Body with Detachable Limousine



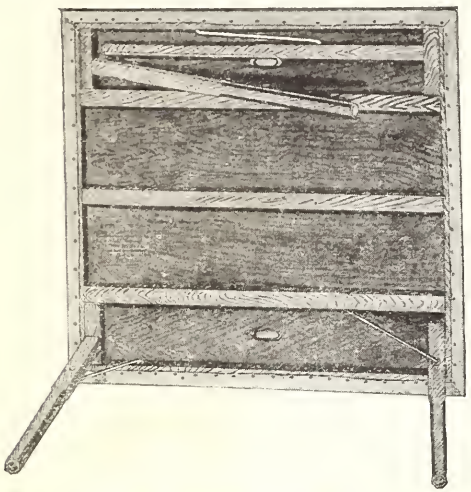
Limousine Detached

With the great majority of machines the substitution of a limousine for the regular open body entails much labor and expense.

¶A reinforced concrete building, 295 ft. high from street level to the top of its towers, has been built in Liverpool, England.

HOW TO MAKE A FOLDING CARD TABLE

The accompanying sketch shows the details of a card table that can be folded up and carried about or stored away when not in use. We would advise



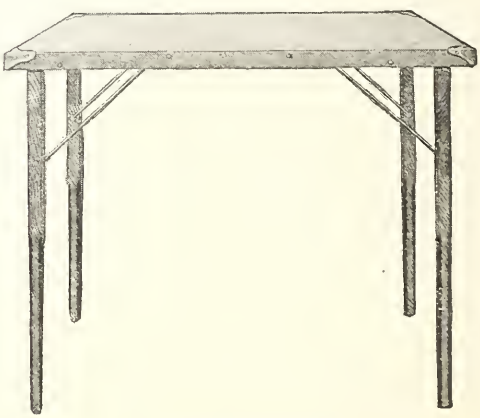
Legs Extended and Folded

making two tables at the same time, as the material for both can be purchased nearly as cheaply as for one. The material necessary for making one table is given in the following list:

1 piece, ⅞ by $1\frac{5}{16}$ by 27½ in., basswood or poplar.
2 pieces, ⅞ by $1\frac{5}{16}$ by 29¼ in., basswood or poplar.
4 legs, 1 in. square, 24¾ in. long; oak.
4 pieces, 1 in. square, 5 in. long; oak.
4 side pieces, ⅜ by 1⅜ by 29⅝ in.; oak.
4 pieces, 27½ in. long, single groove electric wire moulding with batten.
1 piece cardboard, ⅛ in. thick, 29¼ in. square.
4 pieces brass rod, $\frac{5}{16}$ in. diameter, 15 in. long.
30 small copper washers, ⅜ or $\frac{7}{16}$ in. outside diameter and drilled $\frac{5}{16}$ in.
4 brass corners, 1⅜ in. deep.
2½ doz. No. 5 oval head brass screws, ¾ in. long.
4 No. 2, ⅞-in. rubber screw tips.
1 piece felt, 1 yd. square.
1 sheet wadding, 1 yard square (if pad is wanted under felt).
1 pt. wood stain.
3 doz. No. 14 wire beads, 2 in. long.
Some 2 oz., 4 oz., and 6 oz. flat-head tacks.

Begin by squaring up the four legs, making them all 24¾ in. long and 1 in. square. Also square up the crosspieces marked B in the detail drawing. These should be 5 in. long and should have ¼-in. holes about 1 in. deep drilled in both ends of each for the ¼-in. oak swivel pins. Measure back 1½ in. from one end of each and bore a $\frac{9}{16}$-in. hole, ⅞ in. deep as shown. Now cut a tenon, ¾ in. long, on one end of each leg to fit tightly in this $\frac{9}{16}$-in. hole. Round the corners of the piece B at the top as shown at C. Fasten the two pieces together with glue and brads, being careful to get them square with each other. After the glue is set bore a $\frac{3}{16}$-in. hole in the center of the leg, 7 in. from the edge of the crosspiece, for the brace rod. Bevel the corners as shown. Sandpaper them smooth, then stain and polish.

Lay the two pieces marked D and E in the sketch on a level surface with the ⅞-in. edge up, place the cardboard on top and tack it fast to the pieces, using 6-oz. tacks. Place the center piece in and tack it fast also. Fasten the ends to the other pieces with brads. The four pieces of electric wire moulding should each measure exactly 27½ in. long, or the same length as the center piece. Fit a piece of wood about 4 in. long in the groove at each end of the moulding, plane down and fasten with brads. Next take the thin batten or covering strip that comes with the moulding and bore a ½-in. hole in the center 6 in. from one end and a ¼-in. hole $8\frac{3}{16}$ in. from the other end. With a gouge cut a slot ¼ in. wide from one



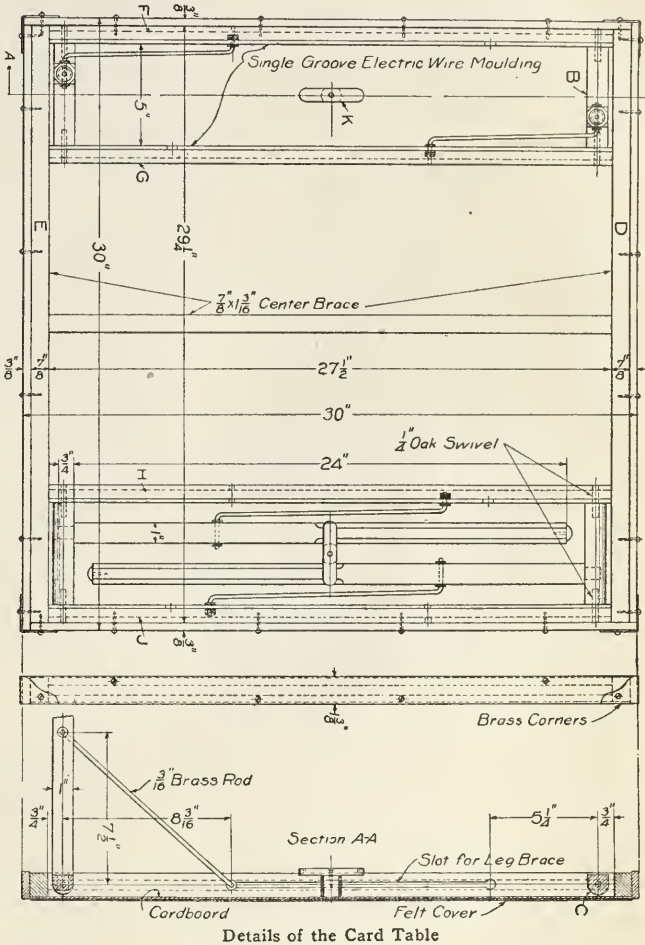
Card Table Complete

hole to the other in the center as shown in the section A-A. Sandpaper this slot smooth and then fasten the batten to

the moulding with small brads driven in about 2 in. apart. At a point ¾ in. from each end and in the center drill ¼-in. holes through the moulding at the small ends of the slots. These are for the ends of the brace rods to spring into, to lock the legs when they are open. Tack the two pieces of moulding marked F and J on the remaining edges of the cardboard with the slots facing in and the large holes of the slots at opposite sides, then place the other two pieces (G and H) 5 in. inside of these, or just the length of the cross ends of the legs, with the slots facing the first two placed (F and J) and tack fast with 4-oz. tacks. Use brads at the ends and be careful that they do not enter the ¼-in. holes. This part of the table can now be stained or painted the same as the legs. The ⅜-in. side pieces can also be stained.

The ends of the brass rods can be bent in a vise. One end should be 1 in. long and should be square with the stock. Measure 11¼ in. center to center and bend in opposite direction leaving this end at a slight angle out from square. Just at this bend raise a burr with a sharp chisel to keep the washer on. Now place five of the copper washers on the 1-in. end and batter the end of the rod so they will not slip off. They should be loose so that they will roll and slip on the brace. Slip a washer on the other end and put the end of the rod through the $\frac{3}{16}$-in. hole in the leg from the short end side, place another washer on the rod, saw off and rivet down the end.

To put the legs in the table, slip the end of one of the braces and the washers in the large hole in the slot, shove it up until the ¼-in. hole in the crosspiece and the one in the moulding meet,



Details of the Card Table

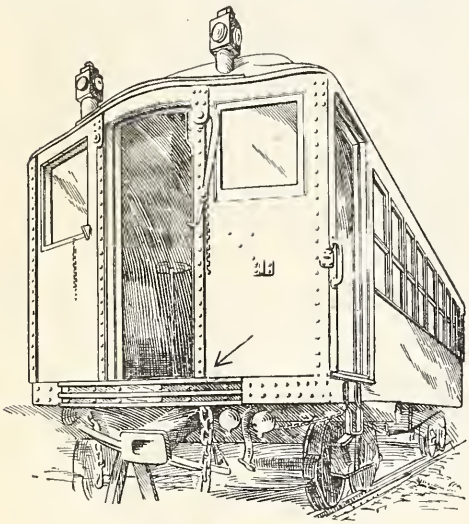
then drive an oak dowel or rod into each end. This is the hinge or pivot that the legs swing on. When the leg is extended the end of the brace rod should spring into the ¼-in. hole in the moulding and lock the leg in place. Rubber tips should be put on the bottom ends of the legs. Two wooden buttons should be made and fastened to the cardboard as shown at K for locking the legs when they are closed.

The felt can now be put on the top of the table. Stretch it tightly and then

tack the edges securely to the sides of the table. Now fasten on the 3/8-in. side pieces and the brass corners with the small brass screws as shown on the drawing, and the table is complete.

DEVICE PREVENTS TELESCOPING OF RAILROAD CARS

A recent collision in one of the New York tunnels, caused by the dense smoke from a fire, which made it impossible for the motorman of one train to see the other, afforded the first practical test of a new device for preventing the telescoping of cars.



Car Equipped with Non-Telescoping Device

This invention consists of two series of large teeth or cogs at the end platform of each car which interlock when the cars come together and prevent them from rising. When the collision occurred, the apparatus immediately and automatically interlocked, and the telescoping which might otherwise have occurred was prevented.

GERMAN SUBSTITUTES FOR TURPENTINE

German concerns are manufacturing substitutes for turpentine in rapidly increasing quantities. It is obtained by the distillation of heavy petroleum from Borneo and sells for nearly two-thirds less than American turpentine. Its greatest use is in the paint trade.

The ordinary light American petroleum is not available for the manufacture of the turpentine substitutes, according to the German manufacturers, but it is believed that some of the grades obtained in Texas and California might yield results comparing favorably with those obtained from Borneo oil.

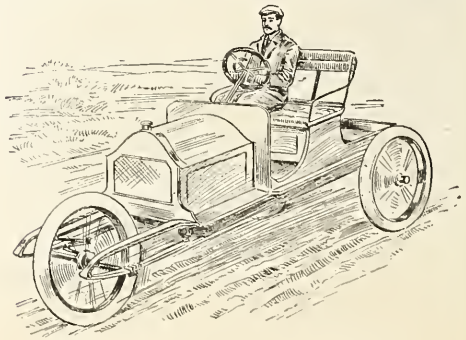
IRRIGATION IN AUSTRALIA

About 2,200,000 acres of grazing land in Australia is watered by artesian wells, and a further area of 380,960 acres will soon be added to the grand total by artesian bores now being undertaken.

Many of the rivers of New South Wales are simply drainage channels running through flat country, flowing after heavy rains and dwindling to a chain of water holes during periods of drought. Ranchers, in some instances, have excavated tanks to catch water for their stock when the rivers were flowing, but this has not always proved successful.

SPECIAL THREE-WHEELED AUTO FOR COSTA RICAN ROADS

The roads of Costa Rica, notorious for deep ruts which make touring with the usual type of automobile almost

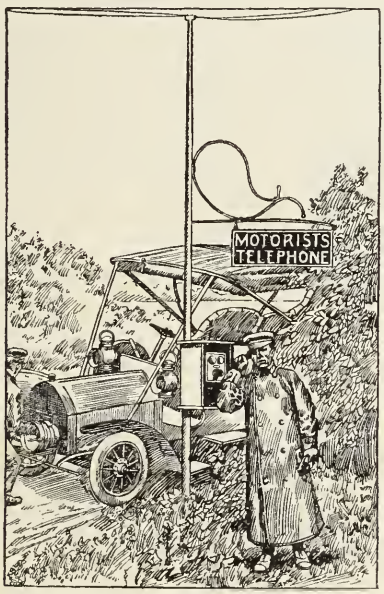


Designed to Steer Car Out of Deep Ruts

impossible, are responsible for the peculiar type of auto shown in the illustration. The car might prove just as useful, however, in other countries afflicted with deeply rutted roads. It is well nigh a mechanical impossibility to get out of many of these ruts with the four-wheeled auto without assistance. With the newly designed car, however, the front wheel runs between the ruts, and makes it possible to steer out of the track. With the exception of the single wheel in front, and the slight alterations of the frame to suit it, the chassis follows the usual design.

AN AUTOISTS' TELEPHONE

In the section about Bournemouth and Christchurch, England, are a number of telephones erected for the express use of autoists. When a machine breaks down, or the gasoline runs short, the driver telephones to the



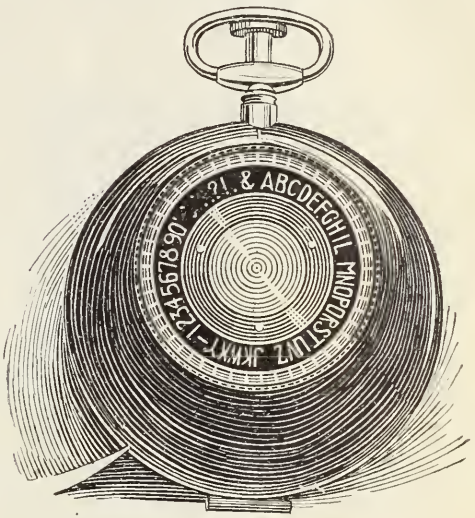
The Autoist's Telephone

garage that forms the center of the telephone system.

The same plan is being tried by several auto-repair concerns in this country, also.

A TYPEWRITER CARRIED IN THE VEST POCKET

This typewriter, shaped like a watch and carried in the vest pocket, can ac-



Watch-Sized Typewriting Device

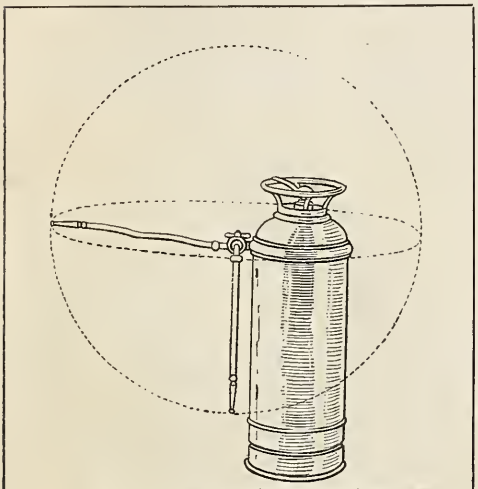
tually be used to make impressions on a narrow strip of paper. The letters, figures, and punctuation marks can be seen on its back. The disk holding them turns, and the typewriter is operated by means of a knob in the ring, to which a chain may be attached as with an ordinary watch.

AIR PRESSURE IN AUTO TIRE KILLS MAN

One of the most curious causes of death in which an automobile has ever played a part occurred at Marcus Hook, near Chester, Pa., when air pressure in a detachable rim tire blew off the bead ring. The automobile was owned by Charles G. Guyer, of Wilmington, Del., and the man killed was Frank D. Marshall, his brother-in-law. The former was pumping air into the tire, and the latter was seated on an embankment watching. The flying bead ring struck Marshall in the face, cutting his head almost in two, and causing his death ten minutes later.

FLEXIBLE HOSE FOR FIRE EXTINGUISHERS

A flexible metal hose attachment for fire extinguishers that may be swung



Improved Hose for Fire Extinguishers

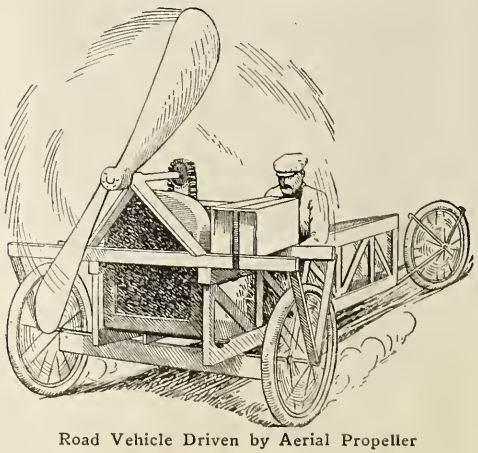
in any direction is shown in this illustration. Vertically it covers 360 deg., and laterally more than 180 deg. The hose is lined with a rubber tubing, and hangs vertically on the extinguisher, a universal joint giving it the wide range of action.

PAY-AS-YOU-ENTER CARS NOT A NEW IDEA IN STREET RAILWAYS

According to the Brooklyn (N. Y.) Rapid Transit Company there were about 50 pay-as-you-enter cars in operation in Brooklyn during the Civil War times. The driver's platform on these cars was entirely enclosed by a metal dashboard, but the conductor was stationed on a narrow seat at the end of the rear platform, the entrance to which was guarded by sliding doors under the control of the conductor. These cars were relegated to the scrap heap, a variety of bob-tail cars being substituted for them. The pay-as-you-enter car bobbed up again, however, in the 90's. Despite the fact that the surface lines of Brooklyn had been electrified previous to 1895, some six or seven short-body horse-cars still performed a shuttle service from Brooklyn, across the Vernon avenue bridge through Long Island City. After 1895 the shuttle service was reduced to one car, a sign along the top of which announced "Pay as You Enter, No Transfers." In the interest of public safety the horse-car tracks upon the bridge were torn up in 1900 and the horse-car was sent to the basement of the barn of the railroad at Third avenue and Fifty-Eighth street to be preserved as a relic. Two years ago, however, it was mounted upon a truck and accorded a place of honor in the parade celebrating the completion of the subway under the East river.—Contributed by G. J. MacMurray, Brooklyn, N. Y.

WIND WAGON MAKES 25 MILES AN HOUR

A wind wagon, the name given a vehicle pulled or driven by an aerial propeller, has been creating considerable interest lately on the streets of Louisville, Ky. It consists of a wooden frame, supported by bicycle tubing and was designed for testing and perfecting



Road Vehicle Driven by Aerial Propeller

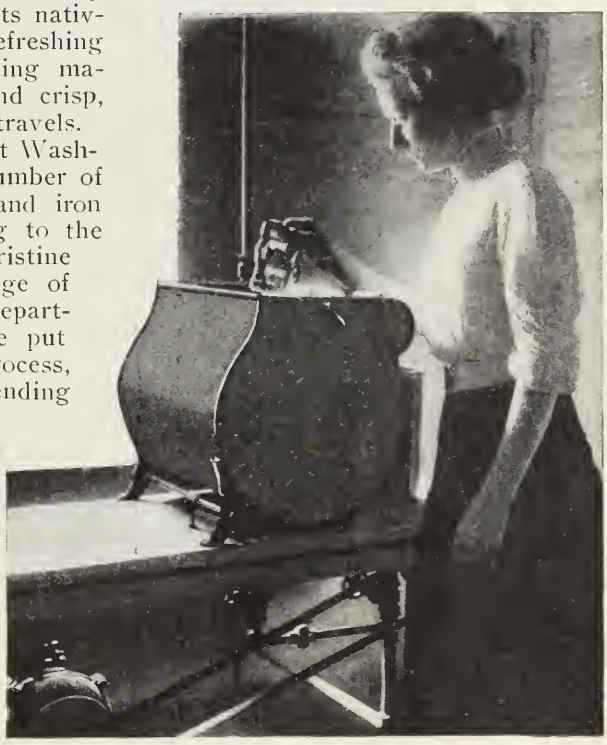
a propeller to be used on aeroplanes. The curious vehicle can make a speed of 25 miles an hour on a good road.

SOILED BILLS MAY NOW BE SENT TO THE MONEY LAUNDRY

After a journey through many hands, now passing quickly from one owner to another, now stored away in some old and worn leather wallet, the soiled and weary dollar bill may take a trip to Washington, the place of its nativity, there to bathe in the refreshing soap-suds of the new washing machines, and emerge, clean and crisp, ready to go forth again on its travels.

The Treasury Department at Washington has just installed a number of machine to wash, disinfect, and iron soiled paper currency, giving to the old and begrimed bill its pristine crispness. A large percentage of the bills now returned to the department for redemption will be put through this laundering process, and returned to the banks sending them in. It is estimated that a billion dollars a year will be subjected to this treatment. Hundreds of thousands of dollars will be saved by the government, for it will reduce the number of bills made every year by the Bureau of Printing and Engraving, that branch of the Treasury Department devoted to the manufacture of currency.

The machines used for the purpose are simple. There is no secret to the laundering operation, for the soiled bill is subjected to about the same treatment that a soiled linen collar would receive. The illustration shows the motor-driven washing machine. "Starching" is the next step, the clean but limp bill being run through a "sizing" machine which restores its surface. It is then placed in a powerful press from which it emerges as crisp and fresh as newly made money.

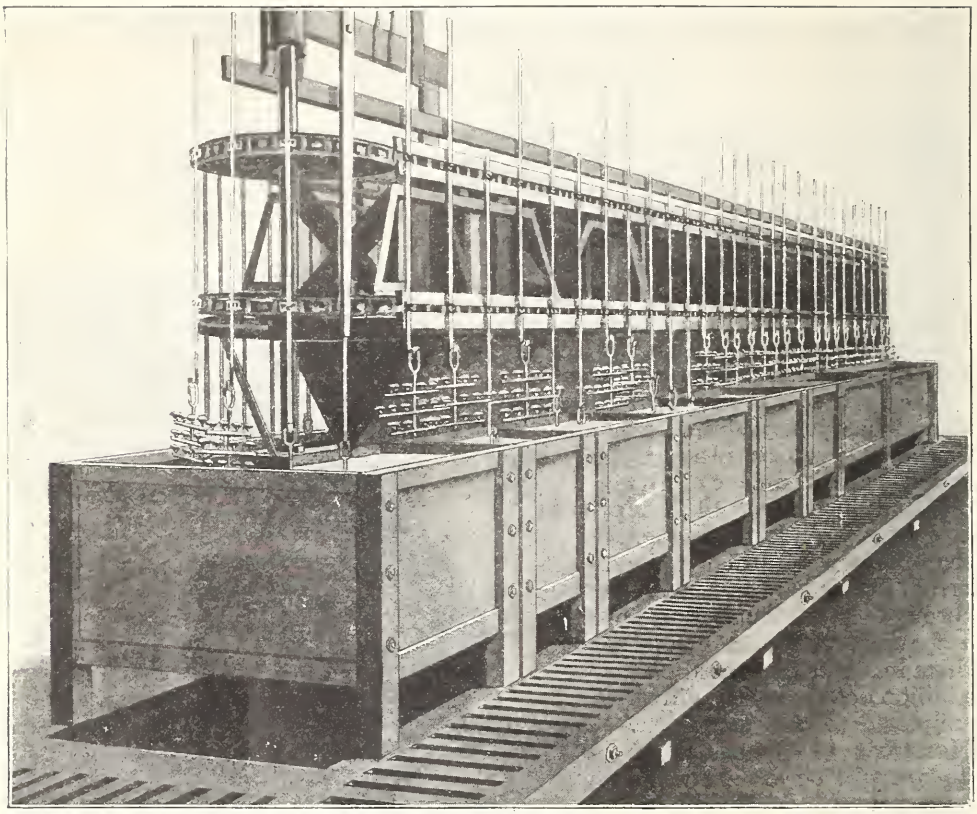


New Washing Machine for Cleaning Soiled Bills

AUTOMATIC ELECTROPLATING MACHINE

An automatic electroplating machine which will accomplish as much work in an hour as the ordinary force of men can handle in a day is shown in the illustration. It was invented by the director and manager of a Canadian manufacturing company, who clung to his idea until he had perfected it, although at the start he was more or less criticised and ridiculed.

The output of the machine is remarkable when viewed from the standpoint of general practice. Steel door knobs, plated with copper, brass, or bronze,



Courtesy Metal Industry

Automatic Plating Machine Which Turns Out 2000 Articles an Hour

are turned out at the rate of 2,450 per hour, while a day's work on these articles as ordinarily done by hand is only 2,000. Door locks, which are plated in the same way, are plated at the rate of 1,800 per hour, while 1,500 has been considered a day's work. Other articles are plated at the same speed. Boys serve as operators.

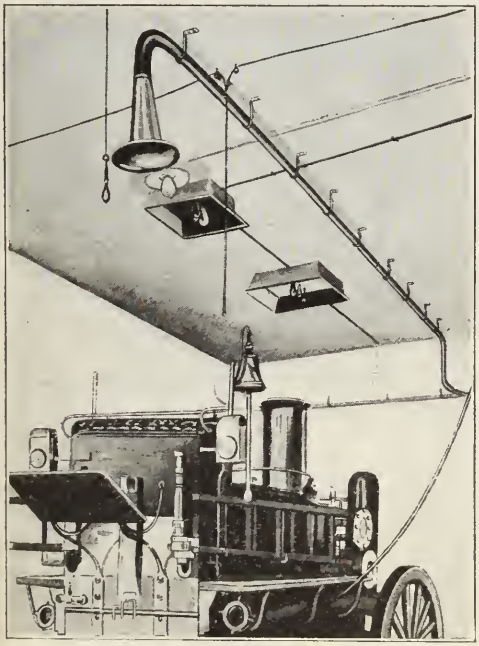
The machine consists of a framework built in the form of an oval. Grouped about this frame are the tanks containing the solutions used in the process. On the framework and close to the top of the tanks runs a metal track in the form of a flat narrow strip. This strip rises sharply to the top of the frame when it comes to the end of a tank and dips again when over the next tank. At regular intervals are placed flat pieces of metal, terminating in hooks on which are hung racks to hold the articles being plated. These pieces are provided with rollers which allow them to be drawn along the track by power.

In operation, the boys place the articles to be plated on the racks and hang them on the hooks. The strip carries the racks over the edge of the first tank, and immerses the articles in a cleaning solution. Then the strip rises, lifting the racks out of the tank, and dips again while over the next tank. This process is carried on until the tank containing the plating solution is reached, the racks being moved steadily along the strip through the entire process. By this time the articles are in condition for plating, and the length of the plating tank is so arranged with relation to the speed of the rack that the articles are completely plated by the time they reach its end. No further operation is needed but to dry in sawdust and finish in whatever manner required.

The electrical contact is made as soon as the racks touch the plating solution, by reason of the track upon which they run being charged by the negative pole of a circuit. There is absolutely no touching of the racks by hands from the time they start from one end of the frame until they reach the other with their loads of plated articles. The power required to operate the machine is only part of a horsepower.

SIGNALING DEVICES IN LONDON FIRE STATIONS

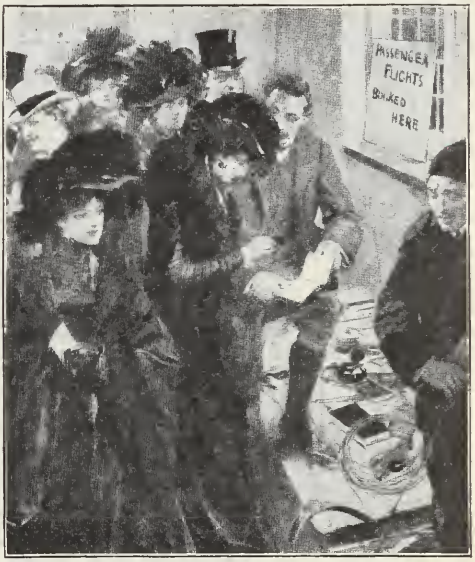
Two new signaling devices have been installed in the fire stations in London to expedite the giving of orders. One of them is a trumpet, hung along the wall in such position that the operator in the watch-room may talk to the drivers on the seats of the apparatus, thus making the shouting of orders unnecessary. The other is a set of colored electric lamps, a different color for each vehicle. The illumination of these shows just what vehicles are to answer the alarm.



Trumpet and Signal Light Arrangement in Fire House

BUYING TICKETS FOR AERIAL FLIGHTS

An extraordinary scene, which before long will seem very ordinary and



Courtesy Illustrated London News

A Ticket Office for Aeroplane Flights

commonplace, is depicted in this illustration. Early in June a booking office was opened at Ranelagh, one of England's aviation fields, for the selling of tickets for aeroplane flights. The price charged for each flight with a skilled pilot was $50, and the majority of buyers were women. The first ticket was sold to a woman of title who desired to experience the sensation of flight. Many other women followed her example.

SECOND-CLASS SLEEPING CARS IN JAPAN

The Takaido line of the Japanese railways has inaugurated a system of second-class sleeping cars said to provide excellent accommodations, as the beds are 5 ft. 9 in. long, an unusual length in that country. A berth only 5 ft. 9 in. in America would be considered too short to be slept in by an ordinary-sized man, but the Japanese are so much shorter that the less than 6-ft. berth is thought very commodious.

Progressive Stages in the Construction of Church Built in a Day

Church Built in One Day

When a wooden building is to be erected in a newly settled country a building bee is arranged, the neighbors for miles around gather on a certain day, and before evening the framing, walls, and roof are up. That such an event, however, need not necessarily have a new part of the country as a setting was demonstrated when a church, 60 ft. long by 24 ft. wide, was built in 10 hours by 200 men of Peoria, Illinois.

Church at Peoria, Ill., That Was Built in a Day and the Workmen Who Accomplished the Feat

The foundation of the chapel, which is known as the West Bluff Christian Church, was laid by its pastor, the Rev. W. F. Turner. At 7 o'clock sharp the men of the Christian Church Brotherhood arrived on the ground and piled the lumber for 65 carpenters, who arrived at 8 o'clock. The work commenced at that minute. The side and end walls were up at 8:45, and the siding was put on rapidly. The rafters were next completed, the roof framework erected, and the strips of prepared roofing put in place. No sooner was the siding on than men with buckets of paint appeared and began to give the building its first coat of white paint. As soon as the painting gang commenced work, another gang started the work of ceiling the interior. At 6 o'clock the church was completed, including much extra work, such as the building of a coal house, grading the church yard, and installing an organ. At 6:30 o'clock the first service was held.

ILLUMINATED BALLOONS TO LIGHT AIRSHIP ROUTES

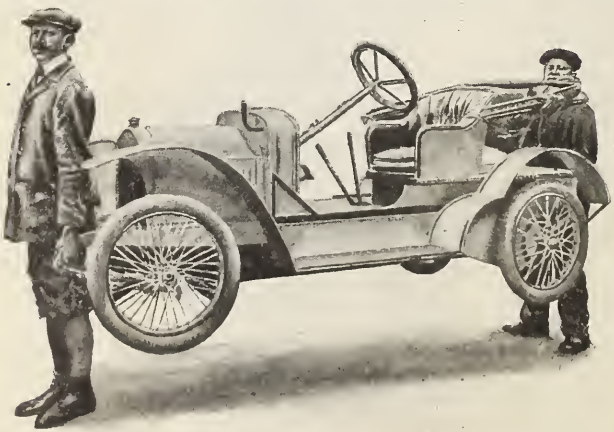
Towers equipped with searchlight projectors are suitable for the lighting of airship routes and stations under ordinary conditions, but fail when the airship is over the clouds or in a bank of fog. In attempting to solve the problem a German inventor has devised a system which consists principally of illuminated balloons made of rubber and containing electric light bulbs. These balloons are carried above the fog or clouds by captive balloons or kites provided with conductors.

ELECTRICALLY LIGHTED CAP WITH LIFE-SAVING APPARATUS

A Belgian inventor has devised a life-saving apparatus that, in addition to keeping a person afloat, protects the neck from the force of the waves and is provided with a cap attachment holding a small electric light. The light greatly enhances the chances of rescue at night, as it can be seen for a distance of a quarter of a mile.

On account of the position of the cushions of this life-saving belt, the neck is protected against the stroke of the waves, preventing the head from tossing about in case of syncope.

It is claimed that in case of an explosion caused by a torpedo, a submarine mine or the wrecking of a ship by other means, all the sailors and passengers can remain afloat and be saved as, owing to the shape and softness of the cushions, the apparatus serves as a pillow, holding the head above the surface of the water.



An Auto Carried by Two Men

The accompanying illustration shows the method of using this "insubmersible" life belt. The apparatus prevents death by immersion as the wind or waves cannot make the body capsize in the water. It is of scapular shape, composed of a breast cushion and a dorsal cushion. The shape of the apparatus and its lightness allow entire freedom to the limbs, so that the person wearing it can execute all the movements of swimming with no inconvenience whatever.

MEN'S COLLARS MADE OF GOAT'S MILK

Imitation celluloid collars made of goat's milk are the latest fad in Paris, as well as being generally adopted by artisans, tradesmen, waiters and coachmen. The milk collars are said to be as serviceable as the celluloid, and to have less of a polish, which makes them a great improvement. In preparing the milk for collars the curds are drained off the whey and subjected to a terrific pressure, resulting in a substance that looks very much like celluloid.

Milk curds have been used in Europe for some years for the making of billiard balls, combs, imitation-bone knife handles, and collar buttons.

EXCEPTIONALLY LIGHT-WEIGHT AUTO

This illustration shows two men lifting an automobile that is making a favorable place for itself on the European market. It is of the small, comparatively inexpensive type of which there are several examples in this country. That it is exceptionally light, even for a small car, is apparent. The motor is a 2-cylinder V-shaped Anzani. The tiny car is very speedy, and is said to be an excellent long-distance machine on good roads. When hood is not used, rumble seat may be fitted at back.

Receiving Messages Through Umbrella Frame

Listening to Wireless Caught by Up-ended Wire Cot

ODD AIDS OF "WIRELESS" AMATEURS

By P. J. BURROWS

IN a little Philadelphia home, F. B. Chambers, a wireless enthusiast has been demonstrating the wonderful possibilities of aerial communication. The popular idea that to converse by wireless entails a large preliminary expenditure for an outfit is quite a mistaken one. This man talks to his wife through the ribs of an umbrella, through a common dishpan, and by means of such ordinary material as a wire clothesline.

The possibilities of using this form of wireless communication that suggest themselves are unlimited. For instance, it will be easy for boys who are camping to be in touch with their homes by merely stretching wires between two trees, the wires being a few yards of clothesline which can be purchased by the reel for 35 cents at any hardware store.

A tin washbowl can be found at any camp or summer cottage and this provides a perfectly satisfactory means of catching the wireless words that cavort around the atmosphere.

But if the campers have been so forgetful as to omit a tin washbowl from their equipment, then there are several substitutes within easy reach. Chambers proved this by up-ending a cot that had a wire support for the mattress and, with this as a receiving implement, the ticking started at once, messages that were being sent to the Philadelphia Navy Yard being plainly heard through the receivers clamped to the ears. There will probably be a

Dishpan Serving as a Receiver

The Chambers' Aerial, Rising Above Roofs on Ninth Street, Philadelphia

dozen other articles lying around a camp or summer home within easy reach that can be adapted to receiving wireless messages in the way explained.

It is not possible, of course, to send messages by the simple devices used in receiving. The conversation carried on through the washbowl, the up-ended cot, or the umbrella frame, is a one-sided conversation. The person holding the umbrella or listening through the washbowl or the wires of the cot can hear what is said from the wireless station at the other end, but he cannot

Catching Wireless with Wire Clothesline

Mrs. Chambers at Wireless Instrument in Her Home

talk back. To do that he must have a wireless station at his end, which of course is only practicable at a permanent home or stopping place, as the installation in a camp or temporary abode in the woods would entail considerable labor and expense.

"I have great fun calling my husband at night," says Mrs. Chambers, who has learned to operate the wireless apparatus at her home. "I agree with him, when he is away from home, to call him at a certain hour and then he can hear all the news by way of the umbrella aerial or by hitching his receiver to an improvised aerial in the vicinity. He also finds it entertaining, he being a wireless enthusiast of the most intense kind, to listen to the messages flying around at night. The appliance which makes it possible for him to receive wireless messages, but not to send any, can be carried in a suit case. It cost him about fifteen dollars to make it and he and I have had many times that amount of fun out of it.

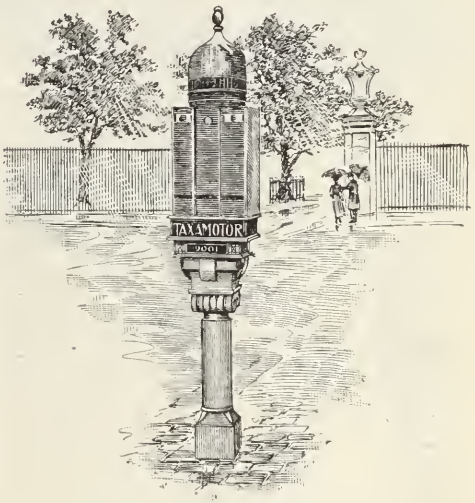
"Sometimes, when he is in the neighborhood of a wireless station, he will fraternize with the operator and then if the station is not busy we talk to each other in the regular way, the aerial we have on the house being as strong as any at the regular wireless stations.

"These mutual talks are interesting, but I have the greatest fun when I get him with his portable receiver and can do the talking myself without his being able to reply. The fun is not lessened by my knowledge of the fact that every wireless operator in the radius is in on the conversation and hears just what I am saying to my husband. The other night he was in the suburbs on business and I tried for a long time to pick him up. All the wireless operators around who happened to be at leisure joined me in the hunt and the air was warm with such messages as: 'Chambers, your wife wants you;' 'Chambers, you're going to get it when you get home;' 'Hello, Chambers, hot-foot it to Ninth Street,' and so on. I learned when he came home that he had caught most of the messages and the following night he amused himself calling up the wireless stations and jollying the operators who had been kind enough to join in the wireless hunt for him.

"It is this novel feature of the wireless operating that makes it so charming. All unknown to the citizens, there is going on in the air above them a constant exchange of ideas by wireless operators who have never seen each other. My husband and I sit in our wireless room in the evening and talk by the hour to the boys who have rigged up stations. It is surprising how many there are who are striving to become proficient in the Morse code."

TELEPHONE CALL-BOX FOR TAXICABS

Telephone boxes like the one shown in this illustration have been placed at many conspicuous places in Copenhagen for the express purpose of calling taxicabs. When the taxicab reaches the box the driver has to report to headquarters, so that the book-clerk can tell just where the cabs are.



Taxicab Call-Box in Danish City

¶The total amount of the cash prizes for aerial flights already won or to be competed for during the year 1910 is nearly a million dollars.

The Coming of a Sandstorm

WOOD-SCREWS WITH SOCKET HEADS

Instead of the commonly used slot across the head of the ordinary wood-screw, this screw is provided with a square socket, which is a radical innovation. A driving point, formed to set in the socket, takes the place of the usual type of screw-driver. The advantages claimed in driving this screw are: No wobbling or slipping of the tools, absolute control in difficult work and no marring of the screw or of the work being done.

¶A man-eating shark, in which undigested human bones and a camera plate were found, was captured recently by the crews of two fishing boats in the Strait of Juan de Fuca, British Columbia. The shark was 36 ft. long and weighed 15 tons.

A SANDSTORM IN EGYPT

During the rainy season in Khartoum, Egypt, sandstorms (haboobs) are of very frequent occurrence. The heavy, sun-obscuring volume shown in this illustration might be taken for the smoke arising from a dozen burning oil tanks, but it is composed of veritable cliffs of sand, swooping along with great rapidity.

When such a storm is seen approaching a community, alarm gongs are sounded and the inhabitants rush to a place of safety.

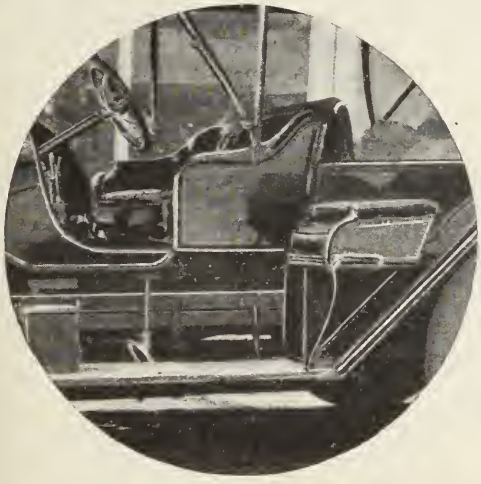
VIENNA'S NEW WATER SUPPLY

Vienna's new water system will be formally opened on Dec. 2, the eightieth birthday of Emperor Francis Joseph. The water is carried from springs in the Alps by an aqueduct about 113 miles long which has 6¼ miles of branches extending to a number of springs not on the main line. Along the greater part of its length the aqueduct, which is about 7 ft. high and

6 ft. wide, is constructed of concrete. Some 45 miles of the length of the aqueduct is in the form of tunneling. The work of construction has been in progress about 10 years and the system will supply 51,300,000 gal. daily, which will relieve the present serious scarcity of water. With the old system only 35,000,000 gal. could be obtained under the most favorable conditions and this has often sunk to only 26,000,000 gal. per day. The water from the aqueduct will arrive in Vienna under sufficient pressure to supply most sections, but there are six small high-service districts to which water must be pumped.

A HANDY AUTOMOBILE SEAT

The problem of carrying an extra passenger on an automobile has been very ingeniously solved by a recent invention, a removable seat which is placed over the running board of the car. It is very small and takes up little room and in some respects is more comfortable than an extra seat crowded into the tonneau. The main disadvantage is that it requires a good strong grip to keep the passenger from being jolted out when passing over the rough places. Also, it is not designed for persons of the build and weight of our chief executive.



Removable Seat for Extra Passenger

OILING THE BATTLESHIP "DELAWARE"

The U. S. S. "Delaware," the first battleship in our navy to burn oil fuel exclusively for auxiliary purposes in port, is here shown taking on a supply of the heat-producing fluid. A little more than 200 tons of oil was brought alongside in the oil barge and pumped aboard in just one hour. Only three men were required to "oil ship."

Pumping 200 Tons of Oil into a Battleship

The "Delaware" has been the instrument of much experiment with methods of burning oil as a substitute for coal in boilers designed for burning coal. These experiments continue, the results being very gratifying. Only a water tender and a messenger are on watch in the firerooms while burning oil, as the oil pumps do the work formerly done by firemen and coal passers. A slight adjustment of valves is all that is required to regulate steam pressure.

When a battleship burning coal exclusively is in port, two boilers are usually required to run the auxiliaries, because of the sluggish draft, while only one boiler is required with oil fuel.

Flying with an Easily Constructed Glider

Belmont, California.

Editor Popular Mechanics Magazine:

I thought that you would be interested to know that a glider, patterned after the plans which you published in your magazine, has been made and was very successful. The accompanying photograph is a picture of me as I was leaving the top of a hill. I could not get more than thirty feet above the ground, nor travel more than a hundred yards, because the hill was not steep enough. All of the better hills around here were so covered with brush that it was impossible to try flying from them.

DE RONDE TOMPKINS.

Projectile Effective as Shrapnel and High Explosive Shell

The German army has at last, according to the "Engineer," London, succeeded in producing a "universal" artillery projectile which is effective both as a shrapnel and a high explosive shell. It is designed for the 4.2-in. field howitzer equipment, and its great advantage lies in the fact that it is available for any particular nature of fire, especially against shielded guns, while the ordinary shells are each designed for a special contingency.

The new shell is, in reality, a shrapnel with a high explosive burster of picric acid in the head. It has the ordinary arrangement of bullets and diaphragm, with a driving charge in the base, but the bullets are packed in trinitrobenzol instead of resin. When the shell is burst in air by the time fuse, the flash from the fuse is led through a channel containing perforated pellets of compressed powder. This channel passes around the high explosive burster, without communicating with it, and leads the flash to the central tube communicating with the black powder charge in the base

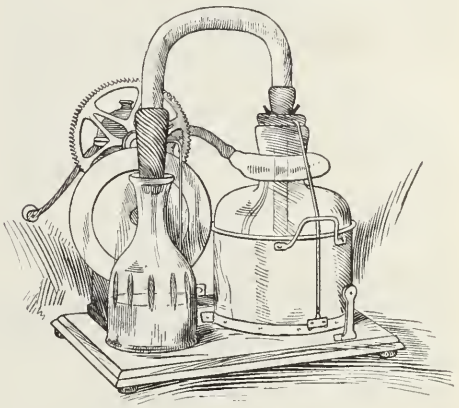
of the shell. The bullets are then blown out in the ordinary way, except that the trinitrobenzol takes fire and burns without exploding, producing a cloud of smoke which increases the visibility of the burst. The head, with the high explosive charge, is blown off, and flies forward, bursting on striking the ground.

The fuse may also be set to burst the shell on percussion. Then the percussion part of the fuse acts upon impact, and the flash from the cap passes to a primer of fulminate, which detonates an exploder of gun-cotton powder, which, in turn, detonates the main picric acid charge. The effect is to burst the shell violently, blowing the bullets and fragments in all directions, even to the rear.

SMALL VACUUM ICE MACHINE

A little hand-worked ice machine, embodying the vacuum process of ice-making, is now being placed on the market. Briefly, the machine consists of a tested-glass sulphuric acid container in connection with an air pump, and a tube for insertion into the mouth of a decanter or other vessel. The air pump is connected with a geared fly-wheel, hand-driven. The acid container is fitted with an enameled iron cover, and the decanter is placed on a rocking holder.

About four turns of the handle of the air pump are sufficient to give a suction



Making Ice in 1½ Minutes

that will lift the water bottle. A charge of ½ gal. of sulphuric acid will provide for about 100 operations. Ice is formed in a half-filled decanter in 1½ minutes after the handle is set in motion.

Aside from making ice, the machine can be used for the making of ice cream, for hardening butter, cooling wines, etc.

SPIKED COUCH USED BY HINDOO FAKIR

The Uncomfortable Couch of a Fakir

During the great religious festival held at the beginning of each year in Allahabad, such couches as this are often seen. They are used as resting-places by fakirs, who thus prove their piety, and as a return receive small coins from the pilgrims.

It is a curious phase of life among Eastern peoples that men who are too lazy to work are not averse to torturing themselves to gain a few pennies.

TILLING THE SOIL WITH DYNAMITE

Probably no stranger use for dynamite has ever been devised than its substitution in place of the plow for the tilling of clay land. It is being put to such a use on a considerable experimental scale in Kansas and by a planter of Spartanburg, S. C.

The first experiment at Spartanburg constituted the exploding of a stick of dynamite in each of a series of watermelon hills, and the resultant crop showed the benefit of the heroic treatment. The next experiment was the breaking up of an acre field by dynamite. The cartridges were planted 3 ft. apart, in rows, and at a depth of 4 ft. The holes were made by driving crowbars to the desired depth. The illustration shows this field planted and ready for the lighting of the fuses, which can be seen projecting from the ground.

The dynamite was exploded by a line of men, provided with red-hot irons. The line went rapidly down the field, the explosions following the men in a steady roar that was deafening. The explosions threw clouds of soil 30 ft. into the air and covered the men from head to foot with dust and dirt.

Clay land such as is found in the southern part of the country, when once disturbed to a depth of four or five feet, is said never to revert to its former solid and impervious condition. One of the great troubles of the southern farmer has been to keep the clay from puddling and holding the water on the surface of the soil.

Plowing with Dynamite—Fuses Can be Seen Protruding from Ground

PNEUMATIC CAISSON SUNK WITHOUT ACCIDENT

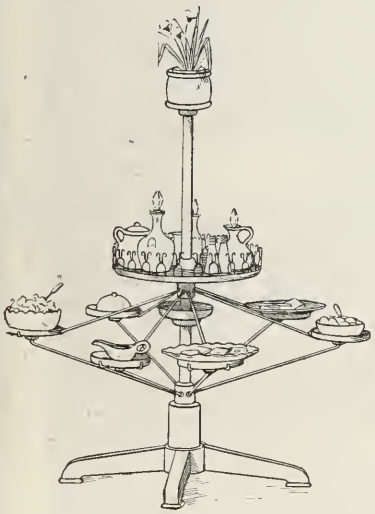
A somewhat remarkable record was recently made in the sinking of a caisson for the Municipal building, New York, during which work not one death or even accident of any kind occurred. The caisson in question is for one of the column piers, and was sunk through sand and rock to a depth of 112 ft. below water level. Its construction was commenced April 15, and the bottom was passed May 16.

The work was executed by 20 shifts, of five men each, working about 40 min. for each shift, with a long

period for decompression and an interval of four hours between the two shifts each man worked daily. The men were under strict medical supervision, improved sanitary and hospital appliances were provided, and a physician was in constant attendance. Not even a single case of bends occurred.

WHIRLIGIG WAITER FOR DINING TABLE

A device described as an automatic waiter is here illustrated. At the ends of the rods, radiating from the central standard, are holders that may be adjusted to different sizes. On these are placed the dishes to be served, while around the center are places for silver,



A Revolving Food Server

and receptacles for salt, pepper and relishes. When the food has been placed upon the waiter the guests revolve it and help themselves.

CHURCH BUILT BY ONE MAN

One often speaks of a church or some other like edifice built by one man, but the impression meant to be conveyed is usually that one man provided the funds for the structure. In this instance, however, it means that one man actually built the church, which is the only stone church in England, and

Church Erected by One Man

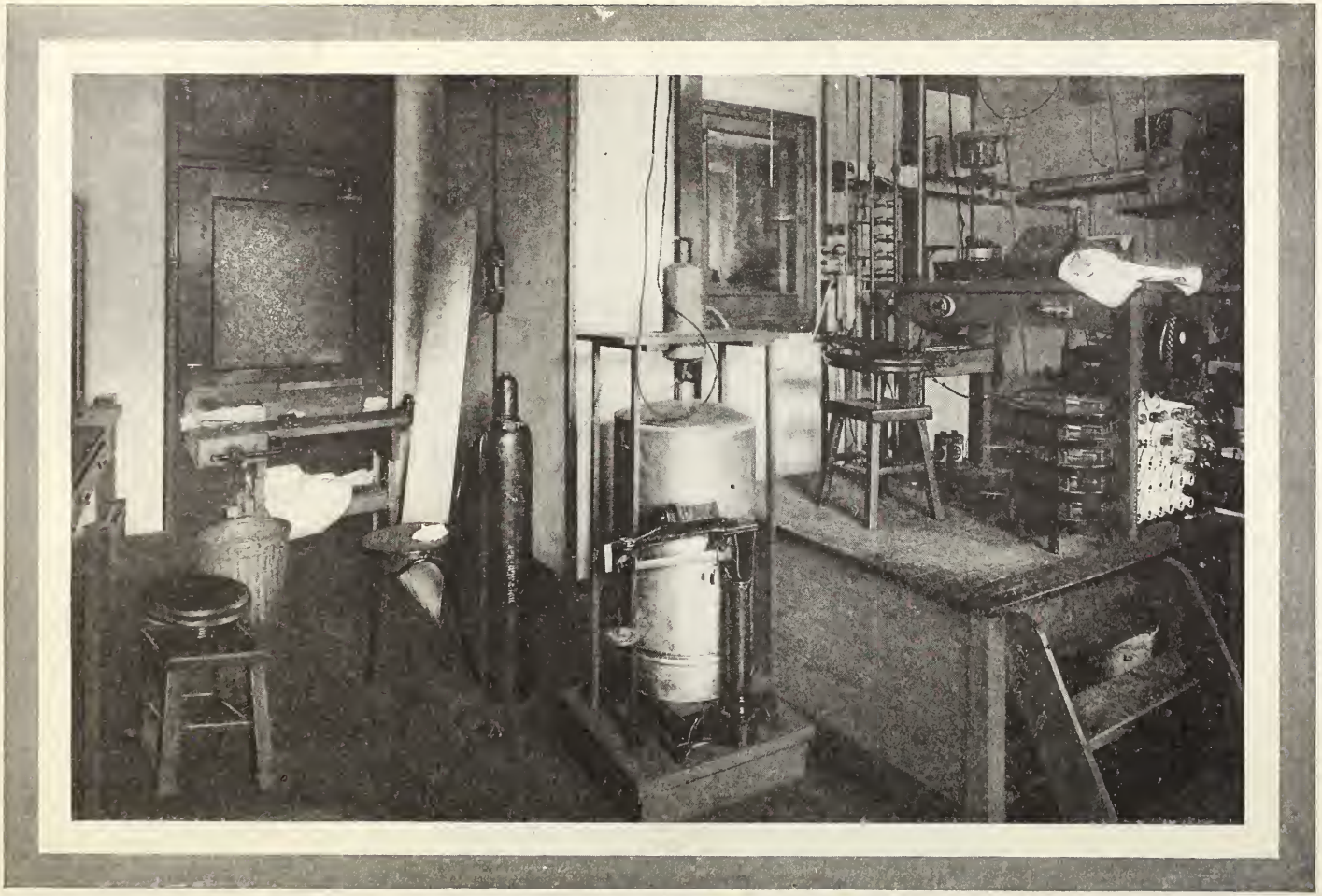
probably in the whole world, of which every stone was laid by one pair of hands.

The church is located at Stivichal, near Coventry, England. John Green, a stone-mason, laid the first stone in 1810, and completed it in 1816, during which time he had no assistance whatever, doing all the work himself until the church was ready for the interior furnishings.

HAILSTONES THAT ENDANGERED LIFE AND PROPERTY

In a storm at Calcutta a few months ago hailstones of enormous size endangered life and property. The hailstones, some of which are shown in the illustration, measured as high as 5 and 6 in. in circumference. The hailstorm was the severest that had visited Calcutta in 40 years.

Hailstones Larger Than Eggs



The "Energy Box" of the Department of Agriculture

Energy Box Determines Food Values

By W. W. RICHARDSON

WHAT is the nutritive value of eggs and toast as compared to corned beef and cabbage?

A popular vote would doubtless favor the last named combination, but would it be the correct answer?

For indisputable evidence on such questions as this the public must apply to the Department of Agriculture at Washington with its wonderful "energy box," a complicated apparatus which figures things down to a gnat's heel and never makes mistakes.

Prof. C. F. Langworthy, chief of the division of nutrition investigation of the bureau of experiment stations, is the engineer who runs the box, and he is finding out new things about food values every day. Technically the box is called a calorimeter, but those who know it best prefer the other name.

The room in which the "energy box" is built is of ordinary size and every available space is occupied. In one corner is the box, not unlike a big ice box or a miniature cold storage plant, with double doors and a double glass window on the side. Communication is had with the interior by means of a telephone. All around the walls of the box are coils of pipe filled with distilled water, the temperature of which is known to the fraction of a degree before the experiment begins. An easy chair, a table and a bicycle, suspended wheels-free from the floor, complete the fittings of the chamber.

A man enters the box, and food, carefully prepared by one of the department cooks, is passed in to him. After he has disposed of the meal the subject takes a book or magazine and seeks to keep his mind perfectly at ease. Then the scientists on the outside begin to get busy. Just under the window there is a platform with half a dozen electrical instruments on and around a desk. The observer watches all these closely, taking an occasional glance through the window at the subject.

As the food inside the man inside the box begins to digest little needles and indicators before the observer begin to move. These movements are caused by the rising temperature of the water in the coils of the box, and the heat which causes it comes from the subject's body.

The experiment is finally finished and the observer has in his possession evidence which no one will dare contradict that caviar and Roquefort cheese produce more heat energy than charlotte russe and fudge or maybe the other way. And so the experiments continue from day to day with variations. Today the subject rests after his meal, tomorrow he mounts the bicycle and reels off mile after mile at top speed. Another day he reads mentally restful fiction. At still another time he solves mathematical problems, and thus the process of mental and physical rest and fatigue goes on in order to have recorded with scientific accuracy just the amount of energy developed by various foods, and whether they produce more of this force in a man engaged in active pursuits or sedentary occupations.

The observer's real work begins when he undertakes to tabulate the results. The apparatus has been built up as the result of several years of experimental work by the experts of the Department of Agriculture, and is a model of scientific accomplishment.

YOUNGEST AERONAUT IN FRANCE

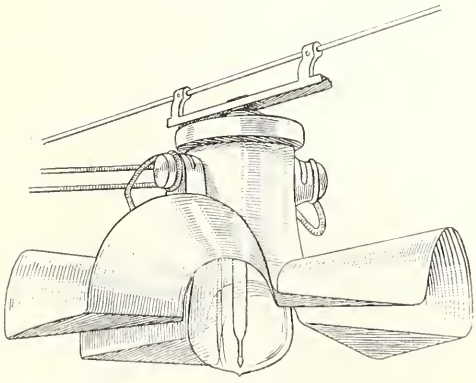
Little Mlle. Etiennette Querbes, a French girl not more than 12 years of age, is called the youngest "air-child" in the world. She has been provided with a Santos-Dumont monoplane, especially constructed for her use, and has flown over short distances on several occasions at Drancy, France.

STAGES IN FIGURE STENCILING

Red Proof | Brown Proof | Gray Proof | Composite Proof

ELECTRIC-LAMP REFLECTOR FOR INTERSECTING STREETS

By means of a porcelain enameled steel reflector, composed of four intersecting semi-parabolas surrounding the lamp, the globe type of electric street lamp is made to cast the greater portion of its light down the centers of the intersecting streets, and only the minimum amount reaches the street corners. When the fixture is suspended



Shade Throws Light Down Center of Street

in the center of a block, a reflector with only two, instead of four, semi-parabolas is furnished, thus stretching the light out considerably.

METHOD OF PICTORIAL STENCILING

The accompanying illustration shows the four stages in the stenciling of a mural decoration, known as "The Pilgrim's Way," by Herbert A. Bone. The completed panel includes a landscape and several figures on foot and on horseback. The figure here illustrated required three stencils in red, brown, and gray. The first three drawings show the red, brown, and gray proofs, and the fourth the composite proof.

Each figure required several special stencils, as did the scenic decoration. How Mr. Bone set about making his stencils for the piece is here given in part as explained by him in the International Studio:

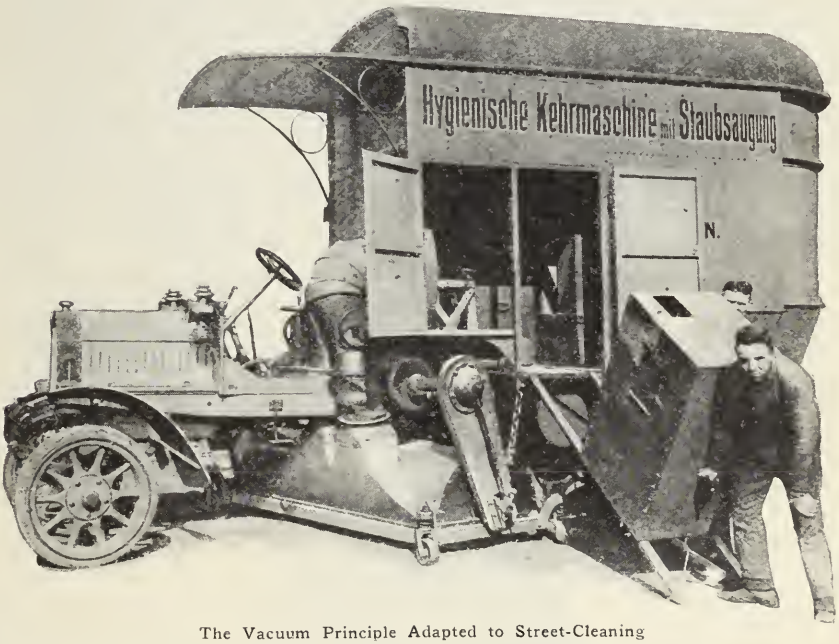
"I first cut a series of figures, and independently, a repeating landscape, in stenciling which the figure contours were screened and kept blank by movable silhouettes. The trees were separately silhouetted and stenciled, and the sloping bank required still another set of plates. This process, in repetition, gives a free hand for spacing and redistribution. The subject permits, for all the figures are on the same errand, a rearrangement of the company now

and then, and a re-appearing differently grouped. The trees being also free, can be made to divide the frieze into panels of any length, thus adapting it to walls of any plan, with continual variety of combination.

"In operation, a paper copy of the landscape is fixed over the canvas stretched upon the table, and upon this the silhouettes of trees and figures are arranged at will. This done, the silhouettes are all pinned down, through register holes corresponding to those in the stencil plates, the paper background withdrawn, and in its place the landscape plates are worked off, over the silhouettes. The broad tints of the hillside are brushed without a plate (which their expanse renders unnecessary), around the silhouettes, and these, acting as an internal stencil, preserve a white contour against the tinted background, which, by its continuity, regulates the subsequent evolution of the color scheme. Where figures are massed, some partly hiding others, the silhouettes are filled after stenciling the background, note being taken of their register holes in the canvas, into which they are again pinned in reverse order, those of the nearest, underneath; those only partly visible, above. Beginning with the last, the stenciling proceeds, silhouettes being peeled off and stencil plates substituted until the lowest layer is reached, when their contours will be found intact for stenciling in full."

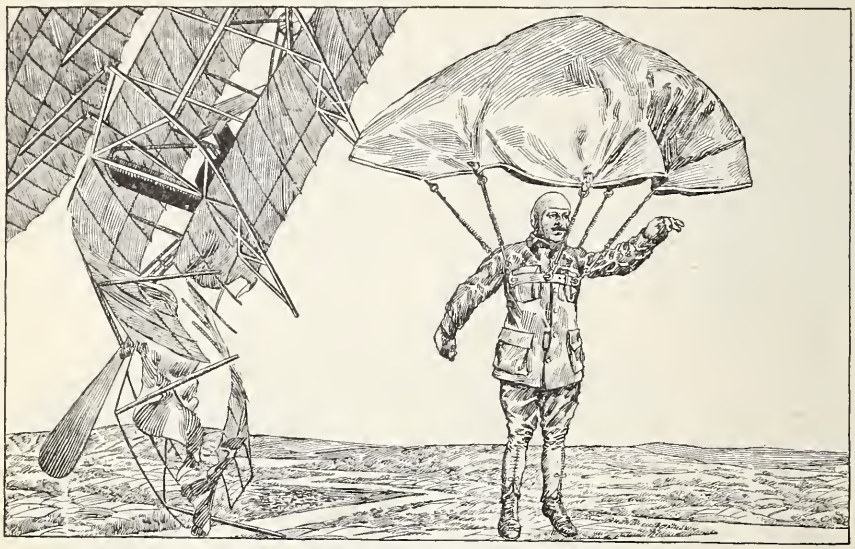
VACUUM STREET-CLEANER

A Vienna engineer has constructed a road-cleaning automobile that embodies the principle of the vacuum cleaner with that of the ordinary street sweeper. A rotary brush, operating under a hood, turns up the dust, which is drawn up through the hood by a strong suction of air and deposited in a metal box. When the box is filled it is removed from the machine in the manner shown in the illustration. The suction funnel and the hood covering the rotary brush can be clearly seen.



The Vacuum Principle Adapted to Street-Cleaning

¶An English railroad is running what are called "egg trains," which carry lecturers who advise the farmers how to conduct the poultry business on a profitable basis.



Aviator's Parachute Extended for Action

PARACHUTE HEAD-DRESS FOR AVIATORS

A parachute that is to be worn over the head of an aviator, with folds hanging down back of his shoulders like a woman's mourning head-dress, but which spreads out in parachute form should the aviator fall, is here illustrated. It is attached by chains to a belt which passes around the body just under the arms. At the moment of the fall it spreads out, and the aviator drops safely to the ground, provided, of course, he escapes becoming entangled in the falling machine.

Aviator's Parachute Worn as Hood

BROOM-CORN ENCOURAGED IN ARGENTINA

When the shortage of broom-corn became apparent in this country, one of the Western concerns handling the product sent one of its men to South America in search of the much-needed brush. He had heard of the fine qualities of broom-corn raised in Argentina, but on arriving there found that the crop raised was not much more than 300 tons.

Accordingly, he

started out to encourage the culture, telling the farmers of the shortage in the United States, and distributing about 100 bushels of seed among them. The growing season in Argentina is just opposite to that of this country, planting time being in September and October, and harvest in February or March. As a result of the man's activity, the crop will probably be boosted to 600 or 800 tons at the next harvest.

RADIUM INJECTIONS AS DISEASE CURE

The injection of solutions of radium into the human body is now being tested as a curative measure by French physicians, while scientific men of the other European countries are watching with much interest. Two cases of lupus and one of cancer have been cured, according to an article in the London Lancet, and much hope is offered for the future.

When introduced into the body the emanation diffuses itself through the structures and may in this manner reach deep seated parts. It has a predilection for the glands which form an internal secretion. The soluble radium is in a free state when injected into the body and carries with it the gaseous emanations which give rise to the phenomenon of radio-activity.

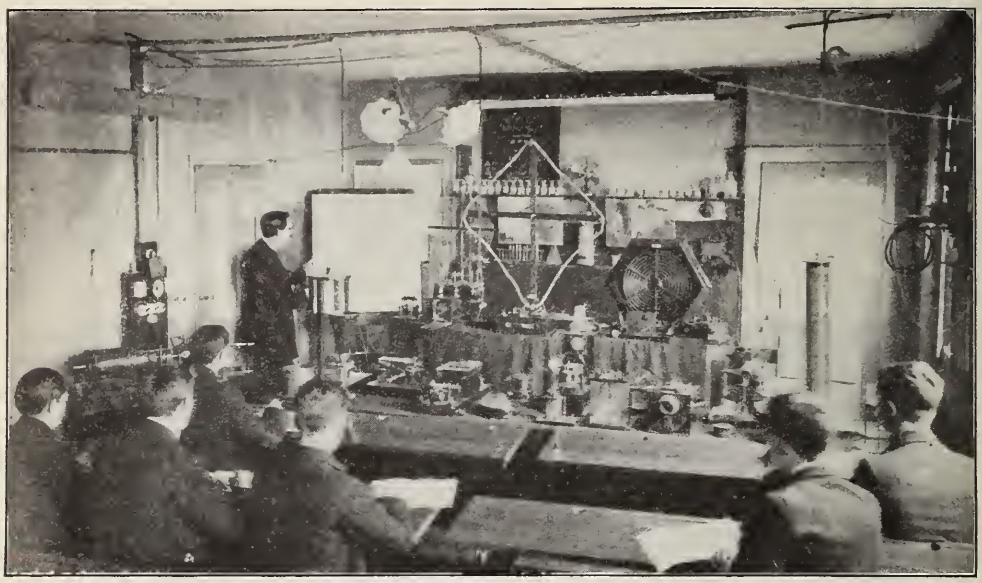
In one of the cases of lupus the lesions on the left side were treated by the application of the radium apparatus and those on the right side by injections. On the left side there was a sharp reaction with the destruction of the lupus and a subsequent process

Roller Skating on a Berlin Pavement

SAILING ON ROLLER SKATES

Sailing on roller skates has now become one of the most fascinating of sports for the younger generation in Berlin. There is hardly a section of the German capital where there are good pavements and comparatively little traffic but a group of boys with at least one sail may be found. The sail is of the same type that has been used by ice skaters for many years. With a good wind it is possible to spin along the pavement at a high rate of speed.

¶Tungsten salts are now used in fireproofing cloth for curtains and draperies.



Wireless Telegraph Schoolroom

of repair. But still later there was a recurrence of the lesion at the margin of the tissues of repair. On the right side there was no visible inflammatory reaction, but there was first a diminution and then a disappearance of the lupus. At the time the recurrence was found on the left side the recovery on the right side was maintained and there has been no reappearance of lupus since.

INTERIOR OF WIRELESS TELEGRAPH SCHOOL

This illustration gives an excellent idea of the kind of a schoolroom in which wireless telegraphy is taught. It is part of a large school of wireless, submarine cable, and ordinary telegraphy. The apparatus in the room represents the various systems, and is used by the students in practical and experimental work.

AN AFRICAN LOCOMOTIVE

The accompanying illustration shows the type of passenger locomotive used on the British railways in South Africa. It has two 5-ft. driving wheels on a side and weighs 43 tons. The tender, the forward end of which forms the back of the cab, weighs 31½ tons.

Passenger Locomotive on African Railway

HEAT

Part VIII—Expansion and Contraction

By J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the eighth article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. The following subjects were discussed in the months indicated: February, "The Nature of Heat and How It Is Measured;" March, "How Low Temperatures Are Produced;" April, "Some Effects of Low Temperature Upon Matter;" May, "The Production and Uses of High Temperature;" June, "High Temperatures and the Rare Metals;" July, "How Heat Travels;" August, "How Heat Is Measured." Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

EXPANSION is one of the most remarkable of the phenomena to be reckoned with in the natural world. Practically every bit of matter from the Great Brooklyn bridge to the tiny hairspring in one's watch is under its imperial domination. It is a tremendous force, and the world of mechanics has to treat it with the deference and respect due to its gigantic power. Unlike gravity, and other forces of nature, it is whimsical, and takes sudden fits and starts, now acting one way, now another. It affects different bodies in different ways, and seems to be at variance with the time-honored forces whose action can be predicted under all circumstances. At least that is what it apparently does. In our meager knowledge of the great underlying laws that control the universe, it is possibly unwise to speak so unkindly of expansion, as though it were a spoiled child in need of correction; its behavior, however, is so contrary to what one might expect, that one is at a loss to say anything else.

Take for example the peculiar action of heat upon water. A pint of water at, say, the boiling point, 212° F., occupies a certain definite volume. Allow it to cool, and the volume steadily shrinks until it reaches the temperature of 39° F. If the temperature of the water be lowered below that point, contrary to all expectation and understanding, the water begins to expand and will continue to do so until it reaches the freezing point. In other words, a pint of water at 39° F. is heavier than a pint of water at any other temperature. Why? We do not know. It is one of the peculiarities before referred to.

Of course, it is a good thing for us that water does not freeze at its point of greatest density. If that were so, ice would form at the bottom instead of the surface of a pond, and the rivers in the Temperate zones would become

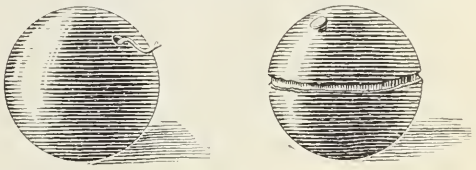


FIG. 1
Bombs Burst by the Expansion of Freezing Water

literally solid masses of ice which the summer's heat could not melt, being protected by the non-conducting water above. This would go on, year after year, until practically the whole continent would become a mass of ice. It might appear at first thought that nature had designed this phenomenon with reference to man's convenience and comfort, but, as Tyndall pointed out years ago, the same peculiarity is true of other substances besides water, as iron and bismuth both expand upon freezing, and solid iron will float in liquid iron, even as ice will float in water.

The force exerted by water in crystallization is enormous. As shown in Fig. 1, thick shells of iron filled with water will break like piecrust when the confined water freezes. We are, unfortunately, on familiar terms with the plumber during the winter season on this account. Some years ago an ingenious device was patented by an English surgeon to obviate the usual results of the freezing of water in exposed pipes. A rubber tube is placed within a water pipe and of such diameter that the space inside the tube is a little more than equal to the increase in volume of the water by freezing.

The rubber tube is filled with air, and when freezing takes place, and consequent expansion, the air will be compressed instead of the pipe being split asunder. Another wrinkle, just as simple, consists in pounding or compressing exposed lead pipes until they assume an elliptical shape. The expansion due to the freezing of the water will cause the pipe to re-assume the circular form, and thus allow for the increased volume required by the ice.

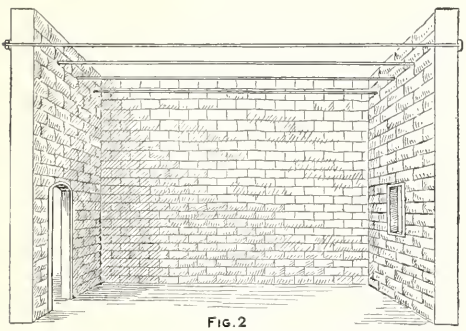


FIG. 2

Rectification of Walls by the Contraction of Iron Rods

About the only reasonable hypothesis which will explain the changes in volume caused by freezing and melting is that of Tyndall, who assumed that the molecules of a body are really little magnets, and that the attraction and repulsion of these magnets causes them to form combinations that occupy more or less space, even as a thousand bricks could be arranged in a multiplicity of ways. This theory also explains, to a degree at least, the fact that wrought iron, iron wire, and cast iron, have different rates of expansion.

Certain crystals, such as the emerald and Iceland spar, when they increase in length in one direction, contract in another. Rubber and iodide of silver are also exceptions to the general law that heat causes expansion, while the absence of heat causes contraction. Dried wood has not the same expansion rate in the direction of the fibers, and perpendicular to their direction. Clay, even when completely dried, will contract when it is submitted to an increasing temperature, and advantage is taken of this peculiar fact in the construction of clay pyrometers for the determination of the temperature of large kilns.

The expansion rates of platinum and glass are practically the same. Upon this fact depends one of the world's great industries, the manufacture of incandescent electric-light bulbs. The current passes the glass walls of the bulb by means of tiny platinum wires, and these wires contract and expand at almost exactly the same rate as the enveloping glass. If this were not so, a vacuum could not be preserved in the bulb, and the delicate filament would be oxidized almost as soon as the bulb warmed up. A fortune beyond all comparison lies within the grasp of the lucky individual who will provide a substitute for the platinum, as platinum is quite rare and expensive, and something must be done soon, owing to the limited supply of this metal in sight.

The walls of a building are sometimes rectified by the enormous force exerted by the contraction of iron rods. Bars of iron are placed so as to join the two walls where the bulging is most pronounced. These bars terminate in screws furnished with nuts. The whole of their length is heated and the nuts tightened. On cooling, the bars will contract with practically irresistible force, causing the walls to straighten up. This operation is repeated until the rectification is complete. Boiler plates are fastened with red-hot rivets. The contraction of the rivets incident upon their cooling draws the plates tightly together, forming a steam-proof joint.

Tyndall, in his work on heat, gives an excellent illustration of the force of expansion and contraction. "The choir of Bristol Cathedral was covered with sheet lead, the length of the covering being 60 ft., and its depth, 19 ft. 4 in. It had been laid in the year 1851, and two years afterwards it had moved bodily down for a distance of 18 in. The descent had been continually going on from the time the lead had been laid down, and an attempt to stop it by driving nails into the rafters had failed;

for the force with which the lead had descended was sufficient to draw out the nails. The roof was not a steep one, and the lead would have rested on it forever, without sliding down by gravity. What, then, was the cause of the descent? The lead was exposed to the varying temperatures of day and night. During the day, the heat imparted to it caused it to expand. Had it lain upon a horizontal surface, it would have expanded all around; but as it lay upon an inclined surface, it expanded more freely downward than upward. When, on the contrary, the lead contracted at night, its upper edge was drawn more easily downward than its lower edge upward. Its motion was, therefore, exactly like that of a common earthworm; it pushed its lower edge forward during the day, and drew its upper edge after it during the night, and thus by degrees it crawled through a space of 18 in. in two years."

A Prince Rupert drop, or Dutch tear, is a curious and familiar example of the effect of contraction and expansion. Melted glass is dropped into ice-cold water and a small, pear-shaped mass of glass shown in Fig. 3 is formed. The rounded end is hard and tough and will resist considerable pressure. If the filament end, however, is broken, the whole mass will immediately disintegrate into a fine powder with explosive violence. If the operation be performed in a flask filled with water, the shock will be sufficient to break the flask. The explanation is simple. The drop of hot glass is suddenly cooled, and a thin skin of cooled glass is stretched tightly over the body of the drop, inclosing the interior mass which has not had time to solidify. When this interior mass does cool, it produces a state of intense strain. The effect of the contraction is exercised equally on the whole mass, and, notwithstanding the strain, the drop remains in equilibrium. This equilibrium, however, is instantly destroyed when any part of the drop is fractured, and the unbalanced strain causes the drop to fly to pieces.

Mention has been made in a preceding article of the effect of unequal expansion upon two different metals that have been bolted together. It is by this principle that the action of the ordinary thermostat, so familiar now as a controller and regulator of the temperature of large buildings, is explained. This device is shown in Fig. 4. R is a rod made up of two different

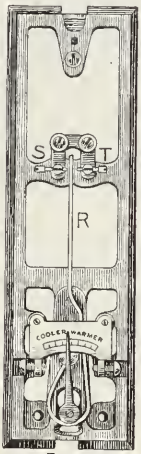


FIG. 4
Ordinary Thermostat

FIG. 3

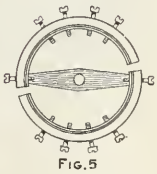


FIG. 5
Dutch Tear Balance Wheel

FIG. 6
Gridiron Pendulum

metals whose rate of expansion are different. When the temperature of the room in which the thermostat is placed becomes too high, the rod curls toward the metal point S and touches it, completing an electrical contact, which causes a motor to shut off the draft. When the temperature of the room falls below a certain point, the rod curls in the opposite direction toward the metal point T. This causes a motor to open the draft and thus furnish a more abundant supply of hot air.

Everybody, in these days of cheap and reliable timepieces, carries a watch. And yet there are very few who appreciate the methods and devices by means of which the troublesome expansion and contraction of metals are corrected, in order that a watch may keep correct time. The balance wheel of a watch corresponds to the pendulum of a clock, and any variation in its dimensions will cause it to move faster or slower, as the case may be. The hair-spring is really a long strip of metal which becomes weakened in its effect when expanded

by an increase in temperature, and has its power augmented when contraction takes place.

To correct both of these conditions, the rim of the balance wheel is made up of two different metals, the outer part

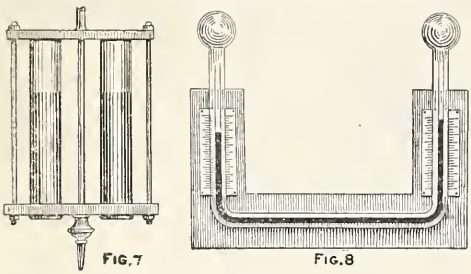


FIG. 7 FIG. 8

Mercury Type of Pendulum and Leslie's Differential Thermoscope

brass, the inner part iron. See Fig. 5. When the hair-spring becomes weaker by expansion, the brass of the balance wheel also expands; but as it expands more than the iron to which it is bonded, it curls in toward the center of the wheel, making practically a wheel of smaller diameter, and causing the same effect as is produced when a clock pendulum is shortened. Exactly the opposite conditions obtain when the timepiece is exposed to extreme cold, and the balance wheel has its diameter increased, thus causing a slowing up to counteract the increased strain produced by the contraction of the hair-spring. The same principle is applied in the construction of first-class clocks. Any uncorrected variation in the length of a pendulum is fatal to the timekeeping quality of a clock. A gridiron pendulum (Fig. 6), made up of alternate rods of steel and brass, serves to correct the result of the expansive force. The central steel rod passes through holes in the lower horizontal framework, and supports the bob at the lower end. The steel rods are so arranged that they will expand downward, while the brass rods expand upward, and the total length of each metal used is exactly sufficient to counteract each other's expansion, and the center of the bob will remain at a constant distance from the point of suspension.

Figure 7 is a representation of the mercury type of pendulum. The rod to which the bob is attached expands downward while the mercury in the two compartments expands upward. By careful experimentation the exact quantity of mercury necessary to preserve an even balance may be determined. Of course, the gross length of the pendulum varies, but as the real length of a pendulum is the distance from its point of suspension to its center of gravity, in the mercury type of pendulum, the center of gravity remains constant.

The metallic thermometer already referred to in a former article is an ingenious device whose action depends upon the principle that different metals have different rates of expansion. As this thermometer was fully described, its explanation will be omitted here. Leslie's differential thermoscope (Fig. 8) consists of two bulbs connected by a tube containing colored sulphuric acid. If one of the bulbs be warmer than the other, the acid will move toward the cooler bulb, due to the expansion of the air in the warmer bulb. This thermoscope is extremely sensitive to temper-

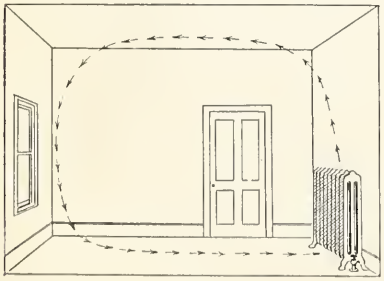


FIG. 9

The Circulation of Air in a Room Heated by a Radiator

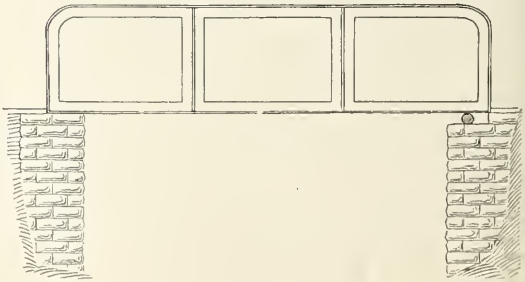


FIG. 10

Roller (on right) Providing for Expansion of Iron Bridge

ature differences. Rumford's thermoscope acts upon the same principle as Leslie's, but has a longer horizontal arm, and contains alcohol instead of sulphuric acid.

Owing to the fact that gases expand much more than solids or liquids, the balloonist who seeks the higher altitudes is in considerable danger. The hydrogen gas or coal gas with which his balloon is filled expands under the influence of the unobstructed rays from the sun and also on account of the lessened atmospheric pressure. Instances are on record showing that balloons have burst from these causes. The United States Weather Bureau sends up into the higher reaches of the atmosphere large numbers of what are termed "sounding balloons." These balloons carry automatic registering apparatus for recording certain data of the aerial ocean. At a certain altitude the rubber bag containing hydrogen bursts, due to the expansion of the gas, and the instruments descend by means of a parachute to the ground.

The contraction of a gas by cooling causes a balloon to become flabby and unwieldy. This is corrected by means of a second bag, called a "ballonet," which is placed within the main balloon, and may be inflated with air by means of a motor, thus maintaining the shape of the balloon. When the hydrogen expands to the danger point, the volume of the balloon may be regulated by letting the air in the ballonet escape through easily controlled valves.

The most important industrial application of the fact that gaseous bodies will readily expand and contract is in the matter of ventilation. Hot air rises. Cold air falls. By taking advantage of these facts, the problem of proper ventilation is easily solved and a steady circulation of air insured, as shown in Fig. 9.

TARGET FOR FISHERMEN'S CASTS

The international competition for fishermen in the Bois de Boulogne, Paris, brought to light a very curious water target. The target floats on the

Water Target Used in International Fishermen's Competition

water, as the illustration shows, and each section of it is numbered. There is also a measure, stretched along the surface. The contesting anglers, provided with high rubber boots, stand in the water back of the measure, and cast at the target.

NO SMOKING LAST HALF OF DAY IS FIRE PRECAUTION

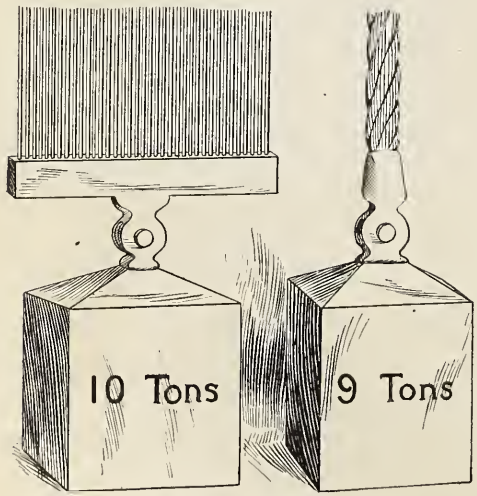
Hanging on the office walls and in the factory of an eastern manufacturing concern are signs which prohibit smoking after one o'clock in the afternoon. The question asked by those who see the signs for the first time is why the employes should be allowed to smoke one part of the day, if not the other part.

Some time ago the manager experimented to find out what time would elapse after the throwing of a lighted cigar or cigarette into different dangerous places before a fire was well started. The results demonstrated that not more than five hours elapsed in most cases before a healthy flame developed. Therefore the manager took five hours as the limit of danger and stopped all smoking at one o'clock, so that if carelessness were to result in fire it would be discovered before the closing hour.

WIRE MADE INTO ROPE LOSES STRENGTH

The method employed in measuring the breaking strength of wire rope has hitherto been based upon the individual wires in the rope, but this, as the two illustrations attest, overestimated the strength of the rope they are formed into.

In one illustration, a 10-ton weight is being supported by 42 wires, and in the other, the same number of wires laid into a rope are supporting only 9 tons. The reason for the loss of one ton, according to the American Wire Rope News, is because of the indirect pull upon the wires and, further, because all the wires are not always under the same stress at the same time.



Capacity of 42 Wires — Capacity of Same Wires Made into Rope

STEAM MOTOR TRUCK OF 20-TON CAPACITY

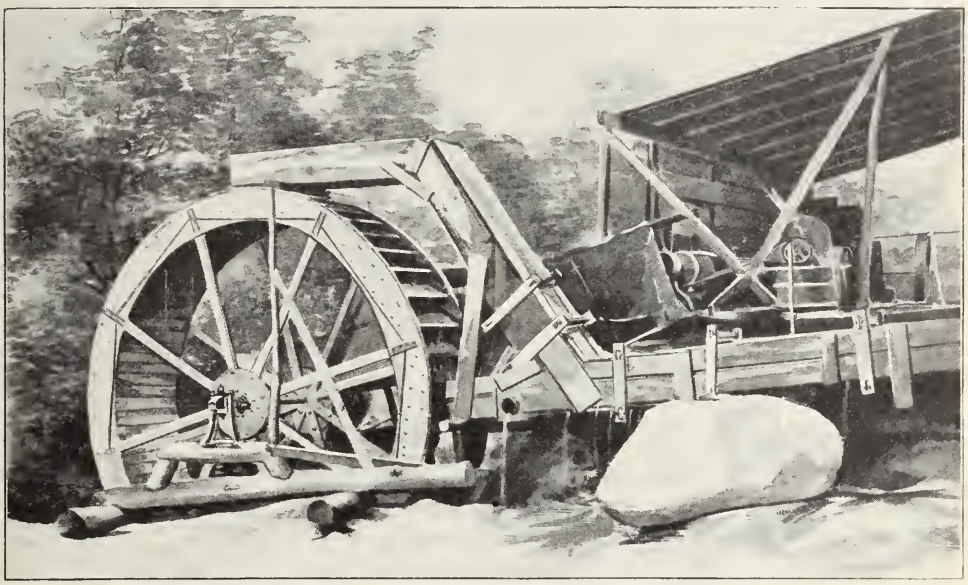
A powerful steam-driven motor truck, burning a specially selected combination of hard and soft coal as fuel, has been built by a large structural concern of Chicago as a vehicle for the transportation of long and heavy beams, girders, columns and other structural material through the streets.

Ingenious Motor Truck Carries 20-Ton Load

A vertical inverted marine boiler supplies the motive power. It is rated at 30 hp., but can develop 40 hp. when working at its full capacity. Steam is supplied by a marine water-tube boiler with a heating surface of 330 sq. ft. The special combination of hard and soft coal gives no smoke and shows only a brown vapor. The exhaust steam passes through a muffler. The machine carries about half a ton of coal and a water supply of 260 gal.

The length of the machine is 32 ft., and its carrying arrangement consists of a pair of 10 by 12-in. fir beams or sills supported at a considerable height above the ground by bolsters resting upon the axles. Across the sills are two shafts, provided with ratchets and levers supporting the chains by which the load is suspended. The steering seat and wheel is mounted about half way back on top of the sills. The driving machinery is in the steel cab over the rear wheels. The illustration shows the machine transporting a long steel column. The carrying capacity is 20 tons, and the weight of the machine, light, is 12 tons, making a total of 32 tons when loaded. The average speed

when loaded to capacity is about 1½ miles an hour. It occupies less length of street and is more easily handled than the ordinary vehicles used for the same purposes, drawn by 6, 8, and 10 horses.



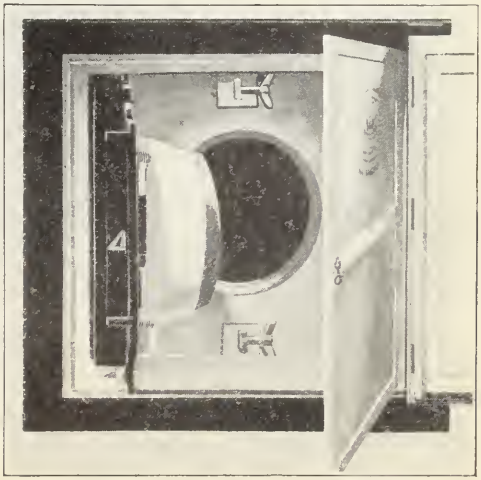
Waterwheel Provides Power for Massachusetts Home

WATERWHEEL LIGHTS HOME AND RUNS MACHINERY

The overshot waterwheel shown in this illustration is not a relic of early days, but a modern home-made wheel built by Arthur Scott, of Woronoco, Mass., to furnish him with power for several home tasks. The wheel is 14 ft. in diameter, and drives a 110-volt generator, which furnishes sufficient electricity for fifteen 16-cp. lamps in his home. He also uses the wheel to furnish power for running the laundry, sawing wood, and turning a grindstone.

THE RADIUM SAFE

The safe recently built by the British Radium Corporation was described in a recent issue of this magazine. Accompanying is a photograph of the wonderful depository. Steel is, of course, powerless to confine radium emanations, since they pass through the thickest armor plate as readily as sunlight passes through plain glass. Lead is the only metal which radium cannot penetrate, and the safe was, therefore, lined with it. To prevent the loss of the radium emanations when the safe is opened, two valves have been inserted and tubes containing mercury are passed through before the door is unlocked. These tubes collect and store the emanations.



Can Hold Five Billion Dollars' Worth of Radium

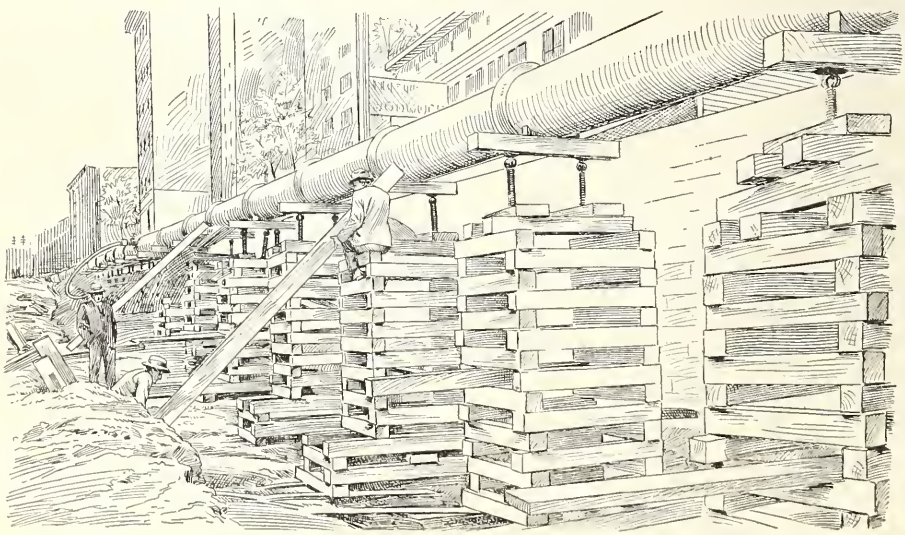
SMALL CHURNS FOR CITY HOMES

There seems to be no reason why the city dweller should not follow the example of the farmer in making his own butter. Cream, it is true, is much higher in the city than in the country, but so is butter. With such a churn as this the housekeeper can take the cream which sours and is otherwise often wasted and turn it into a pound or half of butter in from two to five minutes.

RAISING QUARTER OF A MILE OF WATER MAIN

In the course of the work of grading the city of Seattle, Washington, one of the streets, Western avenue, was filled in and raised 17 ft. It was necessary to raise 1,400 ft. of 20-in. water main the same height, and the task was an extremely delicate one, for the work had to be done without interfering with the water service. An expert house mover was called in and by means of hundreds of jackscrews, the big main was lifted from its bed and hoisted into the air. Water was carried at a pressure of 130 lb. to the square inch during the work, but not a joint was broken nor a drop of water spilled.

The city is now laying a 20-in. supply main to the West Seattle district where the engineers have been confronted with a situation which requires submarine work. The mouth of the Duwamish river will, at a later date, be diverted into what is platted as the West Waterway, and rather than go to the expense of building an additional trestle for temporary use, the pipe is being laid on the river bed. Four hundred feet of main will be laid under water, divers doing the work. Two 12-ft. lengths of pipe are coupled together at the surface and lowered to the river bottom, where divers, working in a trench dug in the silt by a suction pump, bolt the sections into one continuous pipe. The ends of the 24-ft. sections are equipped with flexible joints, allowing the main plenty of "give" in the settling which is expected to follow before it reaches its final resting place.



Jacking Up a Water Supply

Grabbing the Government Oil Lands

Petroleum Lands Entered on Fraudulent Claims of Gypsum Discoveries. The Agents of Uncle Sam Look the Other Way While Valuable Fields Are Seized—Inadequate Land Laws the Cause, Yet Congress Fails to Provide the Remedy.

By Guy Elliott Mitchell

WHO would expect to put gold and silver in the same class with natural gas and petroleum? Since oil and gas are not vegetables, nor yet animals, they are perforce minerals, and as such, if a man wants to locate either of them on the public lands, he must do it under the gold placer law.

Doubtless, when the placer mining law was enacted no one in Congress had any idea that it would ever be required to cover the location of mineral deposits such as oil and gas. Yet when oil was found on the public lands, there was no other law under which it could be located, nor is there today. One great reason for the land frauds which have persisted in the West is faulty and inadequate land laws. The laws have invited fraud and in fact have made it almost necessary, if men were to keep up with the procession.

The principal reason, and it is a good one, for the fraud and the evasion of law in oil locations lies in the fact that the basis of a location under the placer mining law is discovery. In the case of oil actual discovery can be stated only after the drilling of a well, an expensive proposition. Moreover since oil flows willy nilly, an adjoining claim may pump out the oil originally underlying the land of the discoverer.

Fanciful Workings Under a Gypsum Claim to Obtain Title to Oil Lands

The consequence is that as soon as

oil is actually discovered in any field every bit of adjoining public land is filed upon under one pretext or another and in many cases simply held without development. That the government should have thus far administered its great petroleum property, worth billions of dollars, under such an absurdity as a gold-placer law shows how wise and up-to-date Congress can be.

A favorite method in some of the California oil fields has been to enter the land, claiming discovery of other minerals, notably gypsum. Numerous

Artistic Trench-Work Used to Evade the Law and Secure Oil Lands

trenches are more or less artistic and fanciful methods of assessment work, done to obtain title to the land, with posted notices, can be seen in the various oil regions. The gypsum, however, on most of the claims is conceded to be of little or no commercial value and as stated in a recent report of the United States geological survey, the entries are simply "blinds" to control the lands for their oil values. Many of the examples of the assessment work are so picturesque as to suggest the fact that the entryman was intent upon deriving as much amusement as possible out of the farce, for himself and the community. The letter of the law, however, under these gypsum entries is probably complied with and the oil entrymen have assumed that in their gypsum "discoveries" they had found a plan of milking Uncle Sam which was so easy and sure, and withal so eminently safe, that they could laugh aloud about it.

But these and other considerations have caused a recent withdrawal from all forms of entry by the Department of the Interior of over 3,000,000 acres of these known public oil lands in California, Utah, and Oregon, pending legislation by Congress to provide for legitimate development of oil and gas lands. In the vernacular, it is now up to Congress to act.

A recent statement of the geological survey expresses the belief that a well-considered leasing law will provide the best method of handling oil and gas deposits by enabling the government to require development work in such manner as to prevent much of the criminal waste now prevalent. In this connection it is stated with significance that the government is not only the largest owner of oil lands at the present time,

but that it is likely to be the largest consumer. The six great Dreadnought battleships in commission and under construction in the American Navy are equipped for the use of both oil and coal and the fourteen largest Destroyers use oil exclusively. The question of fuel-supply by these vessels is certainly an important one and for this reason alone it would seem that the government should intelligently meet the question of the management of its great petroleum properties.

COMBINED OPEN AND CLOSED TRACTION CARS

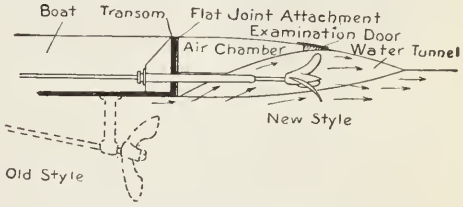
In nearly every part of the country where electric street railways exist people are familiar with the open and closed cars used at different periods of the year, but the car shown in this illustration is a type developed to fit the climatic conditions of the Pacific coast.

In southern California, especially, the climate is so mild throughout the year that at certain hours almost every day an open car is desirable, but a closed car is just as much of a necessity after sundown. Consequently, the car in general use in California has a central closed compartment, while both ends are open.

The closed section of the car shown in the illustration, which is used on the Fresno system, has eight transverse seats upholstered in rattan. The windows are of the usual drop sash variety. The open sections of the car have wood slat seats.

PROPELLER-TUNNELS FOR SHALLOW-DRAUGHT VESSELS

This illustration explains the construction of a high-speed shallow-draught tunnel designed for the ordinary type of motorboats, hydroplanes

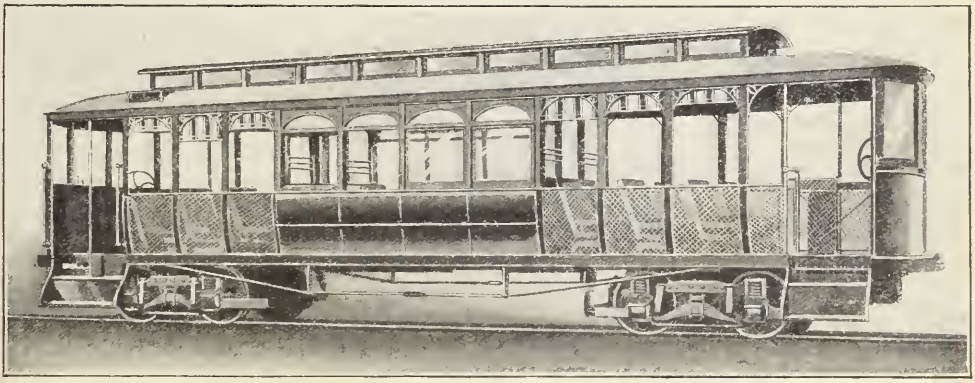


Comparison of Tunnel and Ordinary Setting of Propeller

and shallow-draught vessels. For rivers such as the Congo and Zambesi in Africa, the upper reaches of the Mississippi and its tributaries in this country, and for very shallow lakes, the idea of providing a tunnel for the propeller is admirable.

The illustration shows a propeller mounted in the ordinary way, and one working in a tunnel. Much less than half the depth of water is required for the latter as for the former.

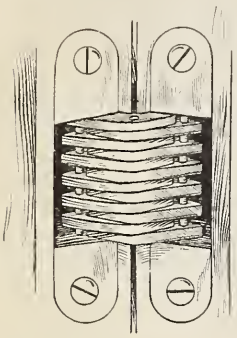
¶The London Daily Mail has offered a prize of $50,000 for a 1,000-mile aeroplane race, beginning and ending in London.



Type of Car Specially Used in California

INVISIBLE DOOR HINGE

This hinge is designed for use where it is desirable that no portion of the hinge should show when the door is closed. The making of the hinge is a somewhat difficult piece of die-casting, but were it to be made by machining in the regular manner, it would be costly. The hinge is cast in metal molds under pressure from a special, hard, white metal. The completed casting is ready for immediate assembling, and requires no fitting or finishing, except plating. The illustration clearly shows the operation of the hinge.



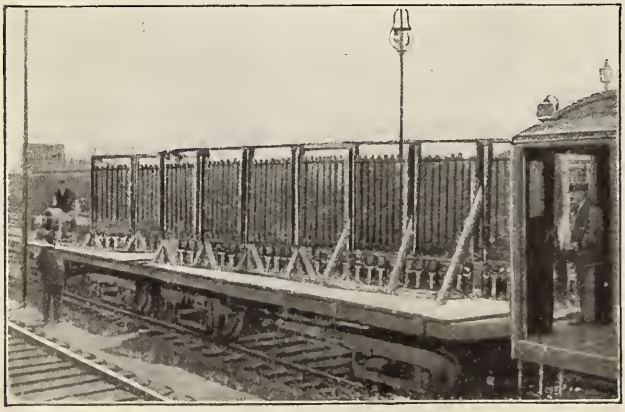
PHOSPHORUS POISONING OF MATCHMAKERS

That phosphorus necrosis of the jaw in a serious form is not at all a rare occurrence among matchmakers in this country is shown by the fact that the secretary of the American Association for Labor Legislation was able to unearth the records of more than 100 recent cases in a comparatively short time. These were found in 15 factories, employing 3,591 persons.

It is in the mixing, dipping, drying and packing rooms of the factories that the danger from breathing phosphorus fumes and from contact with phosphorus is present. Minute particles are believed to enter cavities in the teeth and set up the progressive inflammation and necrosis of the bones.

It is the white phosphorus that is poisonous, and it is the strike-anywhere match of this kind that is principally used in this country. The other kinds of matches are a safety match which contains no phosphorus and is harmless, and a strike-anywhere match in which poisonous phosphorus is substituted by the non-poisonous sesquisulphid of phosphorus.

This last type has been used exclusively in France for the last 12 years, due to legislation that prohibited the use of the white phosphorus. In 1905 a treaty providing for the prohibition of the making and selling of white phosphorus matches was secured by the International Association for Labor Legislation. This treaty has now been signed by France, Great Britain, Germany, Denmark, Italy, Switzerland, and the Netherlands.



Battery of Mercury Vapor Lamps on Flat-Cars

LIGHTING SUBWAY FOR MOVING-PICTURES

Interesting moving-pictures of the New York subway were taken some time ago by means of artificial light provided by the kind of electric light radiated by mercury vapor lamps. The pictures were taken from the cars shown in this illustration. The load the two flat-cars are carrying is a battery of mercury vapor lamps.

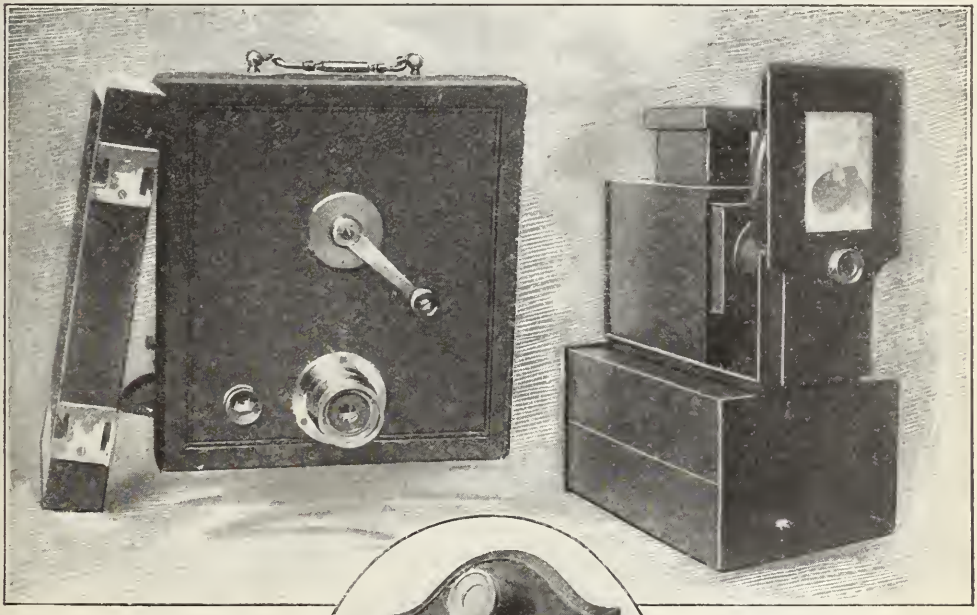
PORTRAITS THAT LIVE

By DR. ALFRED GRADENWITZ

WHILE the ordinary photographic processes have become exceedingly popular, the taking of cinematographic views has, so far, been reserved to the professional masters of the art. In fact, the enormous technical difficulties to be overcome in that direction, as well as the high expenditure, have deterred the amateur from any attempt towards producing animated scenes.

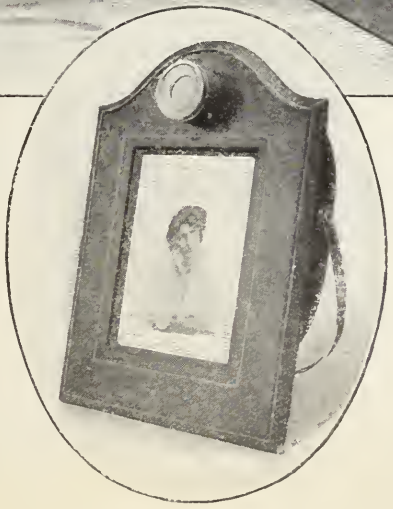
An ingenious apparatus, constructed by Lucien Rieffel of Paris, brings cinematography within the reach of the amateur. While not attempting to reproduce any of those complicated specimens of theatrical scenery which are the result of the development of the craft and the imagination of film-makers, it performs a most useful and interesting work. Whereas, in fact, the ordinary rigid portrait necessarily gives an inadequate idea of the person it is intended to represent, the views taken and inspected in Rieffel's device will produce a perfect illusion of reality by showing that essential element of life, motion.

The outfit consists of two parts: first, the photographic apparatus, allowing a set of successive photographs, 24 or 75, to be taken as easily as ordinary motionless pictures are made with the usual camera, and secondly, an apparatus for the direct inspection or projection of the positive disks, the succession of which produces the illusion of motion. From the negative disks containing



Camera for Taking "Living Portraits"

Apparatus to Project Portraits on Screen

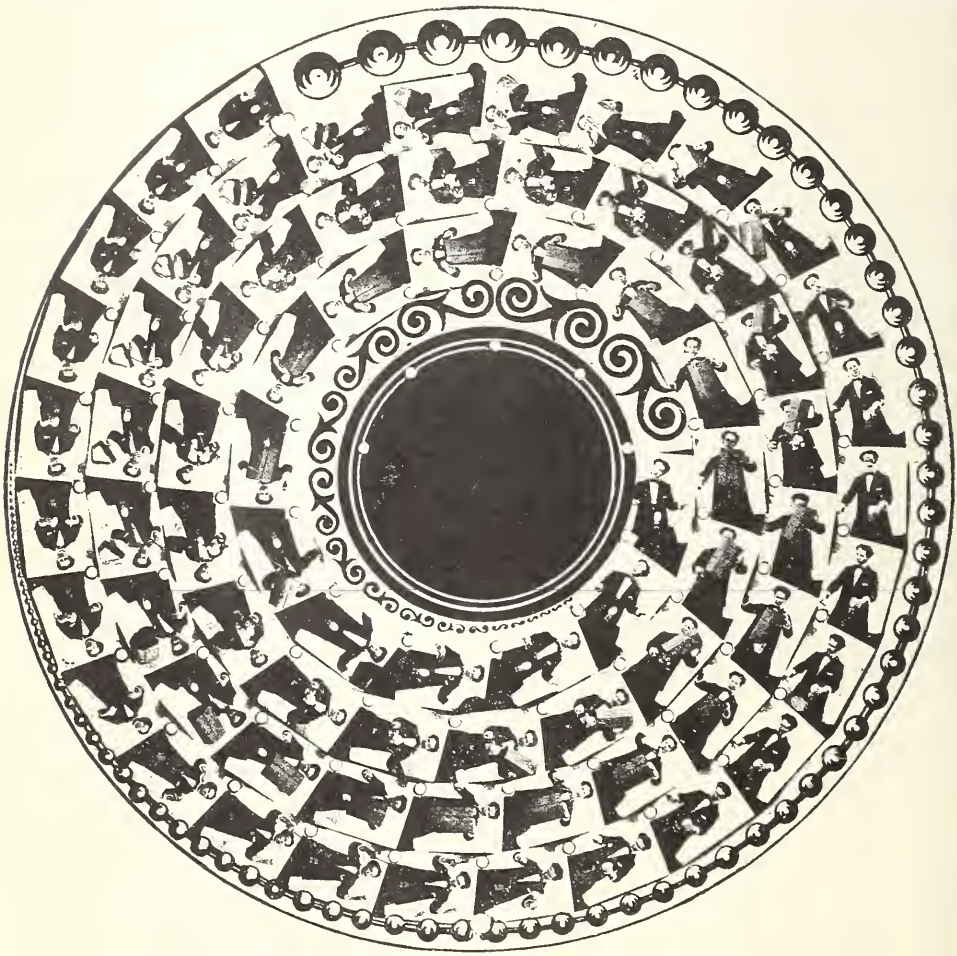


Apparatus for Direct Inspection

these successive views the positive pictures are obtained in exactly the same manner as from any ordinary film or plate.

The camera for taking the cinematograph pictures comprises a circular glass plate, 15 centimetres (about 6 in.) in diameter, on which 24 or 75 successive pictures are recorded. The automatic working of this apparatus is obtained in a remarkably simple manner. In fact, the disk comprises a number of perforations, the distance between which corresponds to the distance between any two successive pictures to be distributed over the circumference of the plate. A special driving gear imparts to the plate a rotary motion, so that the portions destined to receive the picture will be stopped successively during a given interval of time, in front of the photographic objective.

In the apparatus designed for the taking of 24 pictures these are distributed over a circumference of the disk. The latter is accordingly placed in a photographic holder provided with a central knob, around which the circular plate or disk is free to rotate. By pressing down a button, a spring and accordingly a pivot, performing a lateral reciprocating motion, are released, the latter meshing as it were, with the perforations of the disk, and thus producing its rotation.



Disk with 75 Pictures Arranged in the Form of a Spiral

In the 75-picture apparatus, the ar-

rangement is somewhat more complicated. In order to keep the dimensions of the disk within convenient limits, the set of pictures had, in fact, to be arranged in a spiral, so that the disk, in lieu of a simple rotation, had to be imparted a helicoidal motion.

To this effect, the central knob is free to slide in a transversal guide, so that the pivot, in addition to turning the disk round, imparts to it a vertical motion, causing the pictures to arrange themselves spirally.

The objective of the apparatus is, like in an ordinary cinematographic camera, closed by a shutter during the time the moving disk is bringing in front of the objective the portion to be exposed. In fact, the very mechanism producing the motion of the disk also ensures the synchronous operation of the shutter. In order to prevent the sensitive surface of the plate from being exposed twice, which could not be avoided in the case of a continual motion, a special attachment stops the driving gear automatically as soon as the proper number of views has been taken.

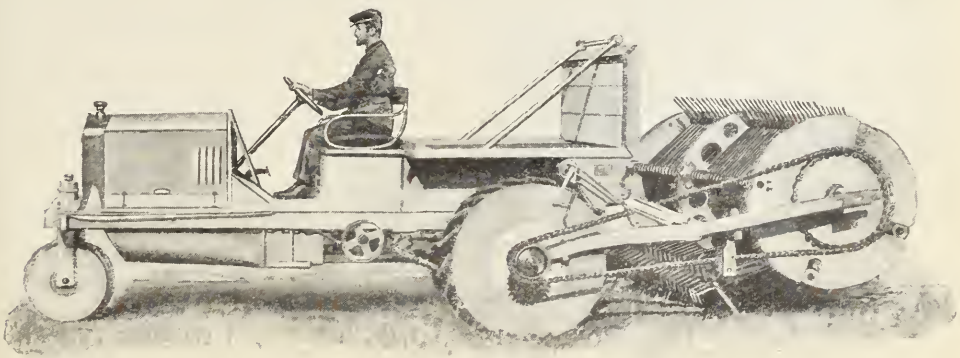
The other part of the outfit, the apparatus used for observing in succession the set of positive disks, is designed either for immediate visual inspection, or for projection on a screen. It comprises a disk on which the pictures are recorded in a circular or spiral arrangement, and a similar hand-operated driving gear which produces the same intermittent motion used in the taking of the views. The speed is considerably reduced, however, so as to produce a more lasting illusion. In case the apparatus is to be used for projection, it is combined with a magic lantern and screen, producing beautiful effects.

The devices thus enable anybody to keep a lasting record of anyone dear to him, not motionless, but in a familiar or typical gesture, and with the very appearance of life. Instead of fixing a single moment, as the ordinary camera, it thus allows a whole episode to be registered and reproduced.

SWISS AGRICULTURAL AUTOMOBILE-PULVERIZER

An agricultural automobile with a peculiar type of soil pulverizer, mounted in somewhat the same way as the stern paddle-wheel of a river steamboat, has been built by a firm in Switzerland for the preparation of light and dry soils which have been worked extensively. It is also used ahead of the plow when the soil is unusually hard.

The machine is of the 3-wheeled type, the single forward wheel being used for steering. The two rear wheels are very wide. The pulveriz-



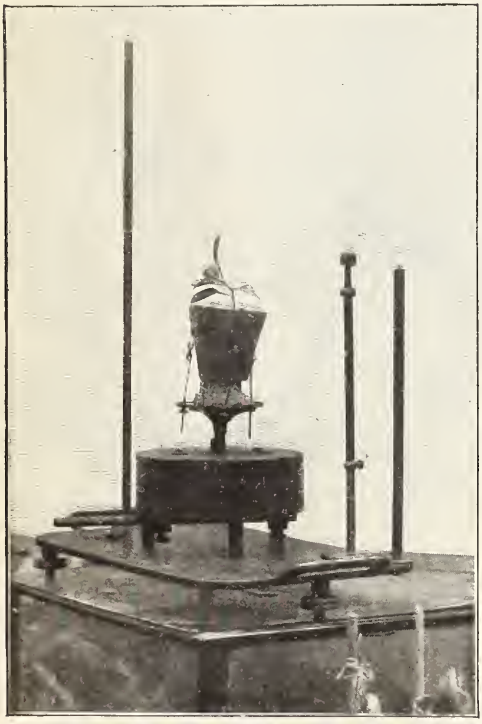
Motor Soil Pulverizer

ing or cutting blades are carried on a drum, which is supported at the back of the machine body, and is raised or lowered by a pulley arrangement, actuated by a small handle at the side of the vehicle. The drum is driven by chain drive, passing over a trunnion at the end of the driving axle.

The cutting blades of the drum are a special feature. The drum is formed by three strong disks, connected by four shafts on which hinge the cutting tools, each shaft holding about 25 blades. Each of the four series of cutters falls back with the drum when lifted out of the soil, and falls out again when the drum has made a little more than half a revolution. The drum, actuated by power instead of by traction, does not retard the forward movement.

DEVICE MAKES PLANTS GROW STRAIGHT

A curious contrivance for enabling plants to maintain their straightness of growth in spite of the tendency of the sunlight to draw them out of alignment is in use at the Philadelphia College of Pharmacy. It can be adapted to any plant stand. If plants are placed in a window, the strong light will cause them to bend in the direction of the illumination. The little machine shown in the picture is a clockwork device that causes the plant to turn and so expose all sides to the light, preventing any distortion in the growth. The plant is made to move very slowly. In fact the movement is almost as imperceptible as that of the small hand of a clock, but it is sufficient to prevent the drawing power of the light from bending the plant from its straight growth.



Prevents Plant from Becoming Crooked

PRESS WHICH PRINTS AND DEVELOPS PHOTOGRAPHS

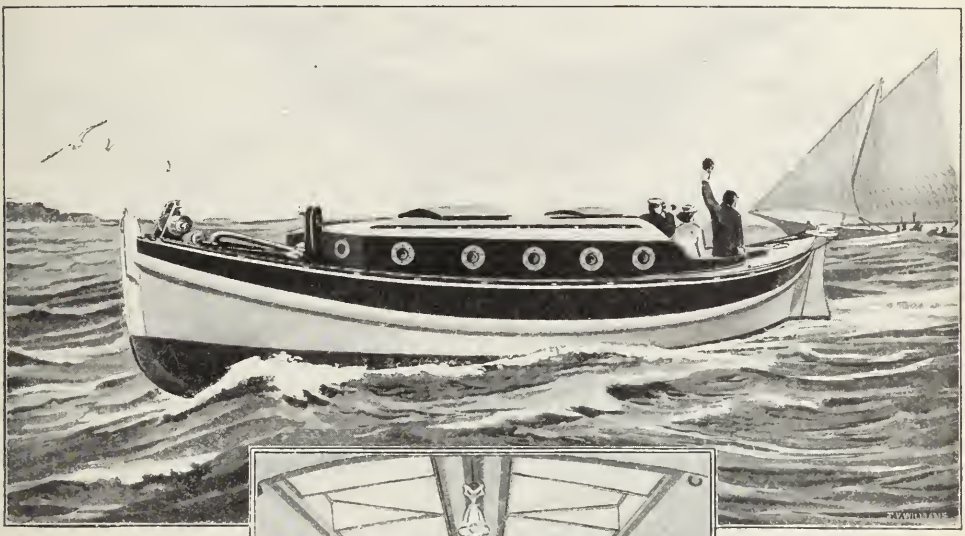
A press that prints and develops postcard photographs at a high rate of speed will, it is said, cut down the price of such cards to an almost unbelievable extent.

In operation, 500 cards are placed in the hopper or feedbox at one end of the machine, from which they are automatically fed into a printing-frame over any negative. After the correct exposure is determined by trial and the timer set for the number of seconds required, the motor is started and the work of printing, developing and fixing is carried on mechanically. The cards finally emerge at the completion of a cycle and drop into large rotary washing-tanks, from which they are taken at the end of an hour, drained and put into improved drying-ovens.

A thousand cards printed in this manner are said to be exactly uniform in tone, color and depth of printing.

¶The sun, shining through the plate-glass window of a store in Charlotte, Mich., ignited a stock of fireworks, causing a loss of $7,500.

LIFEBOAT CONVERTED INTO CRUISING MOTORBOAT



Exterior of Converted Lifeboat

Appearance of Main Cabin

That a lifeboat can be converted into a very seaworthy, comfortable, and handsome motorboat is obvious from the accompanying illustrations. The vessel shown is 34 ft. long, has a 7-ft. 6-in. beam, draws 3 ft. of water, and is constructed with a double shell of mahogany with a layer of felt between.

Under the turtle deck forward is a large locker for stores. Aft of this is a two-berth sleeping cabin, and still farther aft a saloon, also fitted with berths. The forward cabin is 6½ ft. long by 6½ ft. wide, and the saloon is 7½ ft. by 7½ ft. Back of the saloon, on the starboard side, is a lavatory, and on the port side a pantry. The 12-hp. engine which drives the boat is under the cockpit floor.

The boat belonged formerly to the Royal National Lifeboat Institution, England.

Such a motorboat would be stronger than the average motor craft and would behave itself in a heavy sea. The transformation could be made with comparatively small expense, if the boat were in good condition otherwise.

¶A remarkable operation was recently performed at the Post Graduate Hospital, New York, in which a Connecticut man whose jawbone had been eaten away by disease was provided with an artificial jaw of pure gold. One of the most difficult parts of the operation was in shaping the gold to match the original jawbone.

HUGE "THERMOMETER" REGISTERS CONTRIBUTIONS

Improvement organizations in St. Catherines, Ont., recently started a campaign to raise funds for the building of a high level bridge, and the unique "thermometer" shown in this illustration was adopted as a means of attracting interest to the progress made. It was erected on the strip of lawn in the center of the main street of the city, and at its base was the sign: "High Level Bridge—Watch the Stock Grow—St. Catherines First." The mercury was represented by a red ribbon, fastened to a cord running over a block at the top. As the campaign progressed the ribbon was raised to designate the amount received. The highest point the imitation mercury was to reach was the $50,000 mark, which is the amount the bridge will cost.

Increasing the Interest in Money Campaign

The ingenious apparatus was lighted at night by electricity and attracted considerable attention.

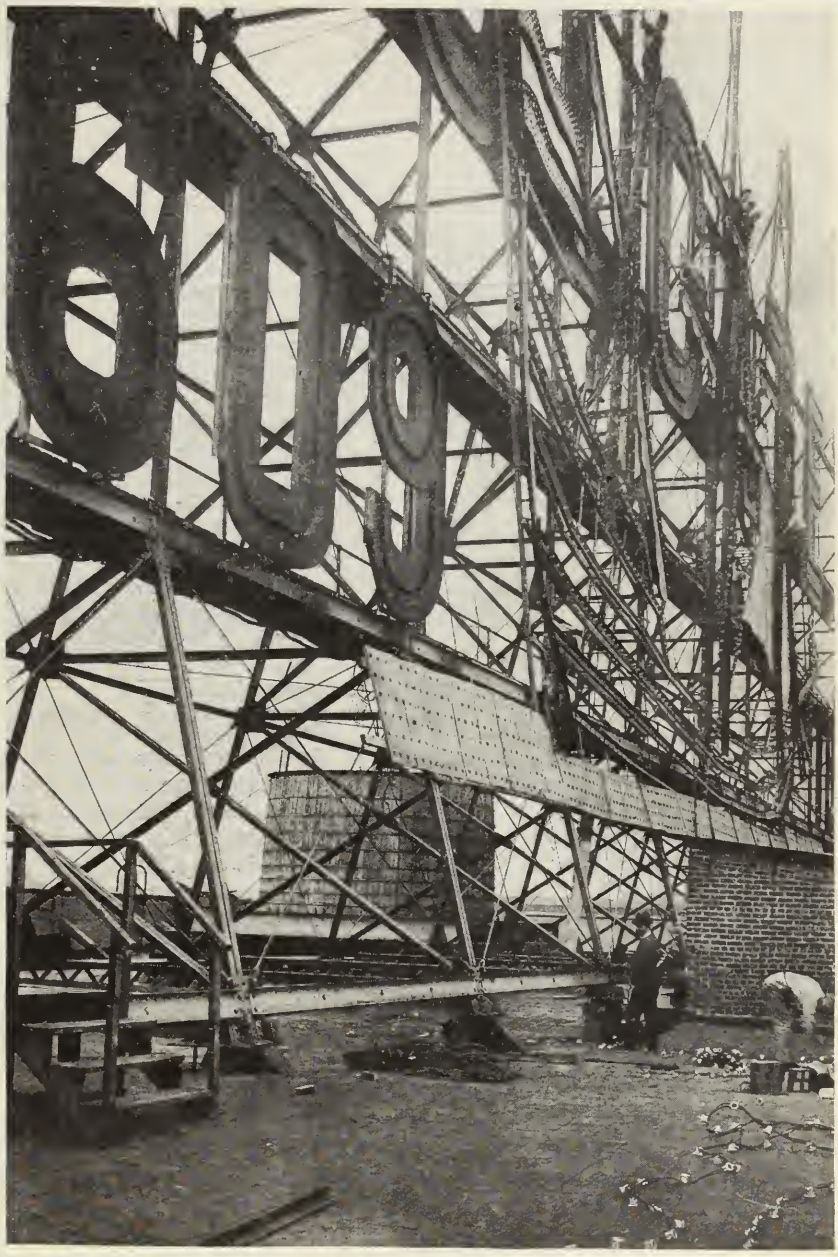
MAKING CHANGING ELECTRIC SIGNS

Electric signs with "moving effects" have become an important and very expensive form of advertising. They carry their messages in the night and are a spectacular feature of the "sky line," especially in New York, where the Hudson and East rivers, with the busy traffic upon them, afford fine opportunities for display.

The sign shown in the photograph herewith is one of the largest ever built and the cost ran well into five figures. It stands on the roof of a seven-story soap and perfumery factory in Jersey City within plain sight from the Manhattan side of the Hudson. The structural steel frame rises 50 ft. above the roof and is 200 ft. long. It is built with three stages for the workmen to walk on when making changes in the design, which is done at frequent intervals.

At one end is a huge clock face, with moving hands and a swinging pendulum below, which keeps accurate time. There are 1,000 four-candlepower incandescent electric lamps in the clock alone, and 4,000 others in the rest of the sign. A temporary feature of the sign, built especially for the Hudson-Fulton celebration last year, was a full-sized reproduction of Hendrick Hudson's ship, the "Half Moon," 80 ft. long.

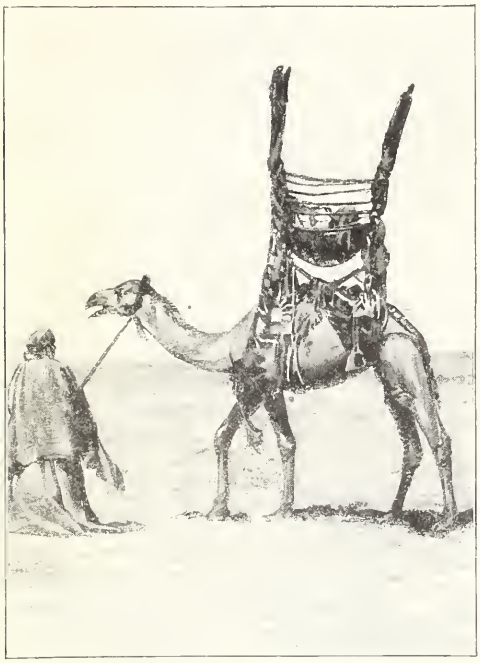
The outline of the ship was formed of trough-shaped strips of sheet metal having sockets into which the workmen screwed the electric bulbs, the wiring for the current being concealed behind the troughs. The sails and the water in which the ship floated were of flat sheet metal cut to shape and painted white and green respectively and plentifully studded with lights. The rope of the rigging was made of a simple pair of insulated wires carrying lights at frequent intervals. Moving effects simulating waves and the swinging of the pendulum of the clock were produced by means of motor-driven machines called "flashers."



Building the Largest Electric Sign in the World

A CAMEL HAMMOCK-SEAT

The curious trapping on this camel, seldom seen anywhere but far in the interior of the desert, is called a "walking hammock" by the English. It is a saddle in which two or three Bedouin women and children can ride at the same time, and is used in the marches from place to place.



Strange Camel Saddle

PHOTOGRAPHING THE SPEED OF BULLETS

A new method of measuring the velocity of a bullet by spark photography, which gives the actual velocity at two given points, as well as the time of flight between them, has been invented by Professor Crantz, author of a standard work on the vibrations of a gun barrel.

The apparatus consists of a horizontally pivoted revolving drum, covered with a photographic film, past which the bullet is fired. The bullet is illuminated as it passes the drum by a succession of electric sparks, discharged at a rate of 5,000 per second. The frequency of the spark and the rate of revolution of the drum being known, the velocity of the bullet can be determined by measuring the distance apart of the images of the bullet. The bullet is photographed at each spark. Were the bullet stationary, the film, when unrolled from the drum, would show a succession of images, one above the other, but the motion of the bullet causes each successive image to be displaced, each being in advance of the one preceding it.

"To measure the reduction in velocity due to the resistance of the air over a given distance," says the Engineer, "two instruments are set up, one at each end of the given distance. The two sparks are simultaneous, since they are supplied by the same source of current, and there is no difficulty in synchronizing the drums, so that the corresponding images of the bullet on each drum can be identified.

CRACKER FOR ALL SIZED NUTS

With the ordinary nutcracker, nuts are often too large or too small to be properly cracked, but with this French invention the cracking of any kind or size of nut is easy. It is in the form of a triangle, and is provided with a lever which, placed against the palm of the hand and pressed, provides sufficient force to crack the hardest shell. The nuts are placed as low down in the triangle as their size allows.

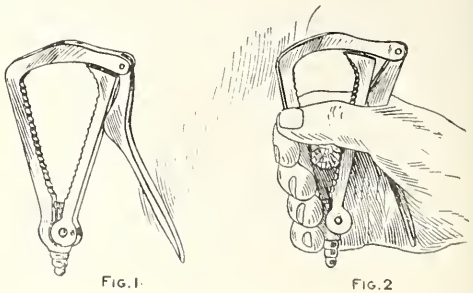


FIG. 1. FIG. 2

A Triangle Nutcracker

MACHINE WHICH MAY GIVE IMPETUS TO HEMP-RAISING INDUSTRY

The introduction of a hemp machine that extracts thousands of pounds a day and cleans it more thoroughly than manual labor can do, promises to greatly increase the acreage of hemp sown in the South. This is especially true of Kentucky, in which state the hemp-raising industry flourished before the war, when each plantation had its scores of slaves to handle the crops.

The New Hemp Machine and the Old "Slat Brake" Process, Used, Without Improvement, for Hundreds of Years

The hemp industry in that state is very old, the fiber having been cultivated in the early part of the last century. In 1859, 75,000 tons was produced. Twenty years later the entire United States produced only 5,000 tons. California and other Pacific coast states have taken up the industry and a fine grade of hemp is being produced in that section.

A steel hemp machine was operated in Kentucky for the first time in 1905, near the town of Paris. After a season's work it was sent to Cincinnati where a lighter machine was made. The second steel machine was made

and operated in the fields during the winter of 1906 and 1907. In 1908, an improved machine was built in Philadelphia and was used for shop demonstrations during that year. Then the machine was shipped to Kentucky and

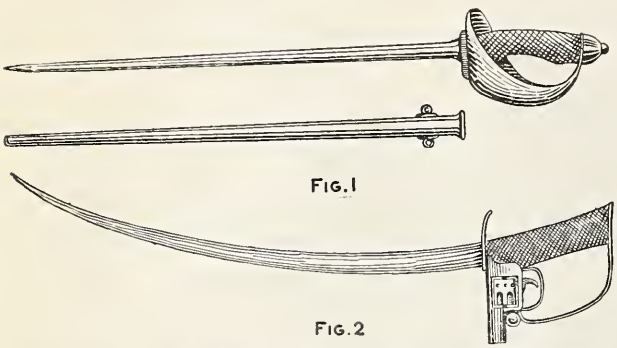


FIG. 1

FIG. 2

New British Cavalry Sword and American Saber-Revolver Weapon

was used in the fields with great success.

The machine is made entirely of steel, makes scarcely more noise than a sewing machine, weighs about 5,000 lb. and is moved from field to field, similar to a wheat-threshing outfit. It requires seven men to operate at full capacity, and delivers 5,000 lb. of hemp or hemp fiber per day. By the old hand method one man does not average more than 150 lb. per day. The machine is run by a steam or gasoline engine and requires only 12 hp.

By comparative tests the machine has made 175 lb. more fiber to the acre than hand brakes under the same conditions. With the machine there is not a stalk wasted, as the farmer can go over his field with a hayrake and collect all the scattered and tangled stalks and run them through the machine, thus saving enough money to pay for the seed. The machine cleans and delivers the tangled stalks, and the product is known as tow, worth half the price of the line fiber.

¶Germany has an improved type of combination automobile and motorboat for use in time of war. The transformation from a land to water vehicle is made quickly, the motor being connected with a screw propeller in a few seconds.

NEW TYPES OF SWORDS AND SABERS

The large sword shown with its scabbard in Fig. 1, while it looks like a relic of medieval times, is really a very modern weapon, being the type just adopted by the British war office for use in the British cavalry. The extraordinarily large and heavy hilt, and the steel knob at the base of the hilt, are designed with a view to bringing the center of gravity of the sword as near as possible to the hand while grasping it. It is entirely a thrusting weapon, having a long, straight, rapier-like blade, sharpened only at the point. To give additional strength in thrusting, an ingeniously devised notch has been placed in the center of the forward part of the grip, on top, in which the thumb rests.

While a first glance would lead one to think the sword is too large and heavy for the ordinary soldier, those who have practiced with it claim it is exceptionally well balanced, and an excellent weapon for mounted troops. When this long, rapier-like blade is compared with the "cut-and-thrust" cavalry saber of the United States army, or the still shorter and heavier saber of the Russian cavalry (which are patterns of swords in use by nearly all other armies), it is at once seen what a radical change has been made by the British war office in selecting this side arm for the British cavalry, and army officers of all countries are awaiting with interest and no little curiosity the results of the adoption of this arm for cavalry use.

The scabbard is of heavy, polished steel, of perfectly plain pattern, tapering slightly its whole length, and is carried on a wide, leather shoulder belt, fastened into two rings firmly soldered to the edges of the scabbard.

The saber shown in Fig. 2 is an American invention. It consists of an ordinary saber with a short, hammerless revolver mounted at the hilt in

such a way that either the revolver or saber may be used without changing the grip.

with pieces of wood from every state and territory in the union. The work is beautifully done, there being not one

Made of Wood Gathered from All Parts of the World and Places of Historical Interest

INLAID TABLE CONTAINS 34,473 PIECES OF WOOD

Phil J. Sargent of Cedar Rapids, Ia., formerly master mechanic in the Burlington railroad shops there, recently presented to the Iowa Masonic Library a table constructed by himself and containing 34,473 pieces of wood of historical interest, the design embracing numerous emblems of Masonic, as well as patriotic, interest. In the lower shelf of the table a figure is worked out

imperfect joint in the wonderful top. In the center is inlaid a stone from King Solomon's quarries underneath the city of Jerusalem, and there is also a piece of wood from the Garden of Gethsemane. One piece was taken from the old elm under which Washington stood when taking command of the Continental army in 1775, at Cambridge. Another was taken from the farm on which Daniel Webster was born. Several presidents of the United States are recalled by the wood used

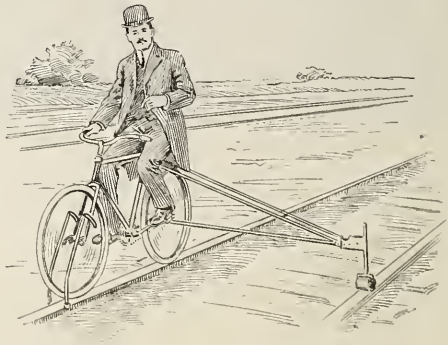
in the construction, and there are also relics of many wars. There is a piece, for instance, from an old liberty pole raised in 1856 in Bow, New Hampshire, that state being Mr. Sargent's old home, and another from the old belfry in Lexington in which the bell was rung to call out the minute men at the commencement of the Revolutionary War. Still other pieces are from the Lexington and Concord battlegrounds. There is a fragment of the original floor of Libby prison, and a piece from the old line battleship "Constitution." To tell all the historical incidents and places commemorated would require several pages.

Many educational institutions are represented, and there is, also, a piece of the old chestnut tree made famous by Longfellow's "Village Blacksmith." The log cabin in Tennessee where Davy Crockett was born, the oak under which Elliott preached to the Indians at Wellesley, Mass., and the San Juan mission in California are brought close together in this interesting table. There is wood also from Panama, Japan, Mexico, Siam, Joppa, Cuba, Argentine, Alaska, Samoa, Manila, Scotland, England, Canada, Germany, Italy and France. Every clime has contributed the choicest of its woods. Central America has sent its mahogany, Africa its ebony, and Japan its camphor wood. The south has sent its tulip tree and the north the sturdiest of its oaks and elms. North Carolina sends the beauty of its rhododendron, the famous Hood River valley the perfume of its apple blossoms and its grape clusters. The pepper tree and the eucalyptus of sun-browned California are there, and the subtle essence of the olive tree, from Palestine. The pure white wood of the English holly is contrasted with the dark beauty of the black walnut, and the rosy hue of the rosewoods is made to harmonize with the precious woods of the Orient.

BICYCLE FITTED TO RUN ON RAILROAD TRACK

A set of attachments, by which the ordinary bicycle can be made to run on a railroad track, has been brought out in France and is said to be meeting with perfect success.

How Attachments Are Carried When Not in Use



Bicycle in Position on Rail

Two distinct attachments are used, one to insure the straight running of the bicycle and the other to maintain the equilibrium. The first mentioned consists of a set of forks attached to the regular forks of the bicycle. The lower ends of these forks bear ball rollers and these, coming in contact with each side of the rail, resist derailment without resulting in enough friction to impede the speed of the rider.

The second attachment is a light

Elliott Woods, Superintendent of the United States Capitol Building and Grounds, Making an Examination of the Air in the Halls of Congress

bicycle-tube framework, bearing a roller at its outer end. This frame is made fast to the bicycle under the saddle and at the hub of the rear wheel, and extends to the second track of the railway. The roller it carries runs on the top of this rail and maintains the equilibrium of the machine.

The possibility of one track being higher than the other, as at curves in the road, is provided for by means of the light bar that runs along the top of the framework supporting the outriding roller. This, operated by a handle within reach of the rider, engages with a mechanism which allows the roller to be vertically extended or drawn closer to the end of the framework, thus making possible the proper pitch of the machine, so that it will always be slightly leaning towards the second rail.

When the bicycle is in ordinary use, the outriding roller and its framework are attached to the upper bar of the frame and the set of forks is raised clear of the ground.

INSURING CLEAN AIR FOR THE HALLS OF CONGRESS

Because of the extremely poor ventilation in the Senate chamber and the House of Representatives, constant vigilance must be exercised to make sure that the men engaged in formulating our laws shall not be surrounded with air full of bacteria and impurities. The two halls of Congress are really inclosed boxes. A system of ventilation was provided, of course, but the opening of a few doors here and there generally put the entire system out of order. The worst conditions are said to exist in the House, near the Speaker's chair, and the best air is found in Senate, around the Vice President's desk.

The responsibility of maintaining the air in the chambers rests upon Elliott Woods, superintendent of the Capitol building and grounds. At frequent intervals during every session of Congress examinations of the air are made by Superintendent Woods, assisted by members of the marine-hospital service.

Gelatine plates are exposed to the air outside the building and other plates are exposed to the air inside the chambers for the same period of time.

The difference in the number of bacteria and the amount of impurities found in each, furnish a test of the conditions inside.

DIGGING A FOUR-MILLION DOLLAR TUNNEL WITH BARE HANDS

One hundred and twenty-five feet beneath the sunlight, in the bowels of one of Seattle's many hills, workmen have been trying for a year and a half to drive a sewer tunnel. In that time, about 550 working days of 24 hours' duration, these human moles have advanced their burrow 900 ft. They still have 3,000 ft. to build.

Ravenna hill is a natural sponge. Its huge bulk is mined with submarine lakes and pockets of water and it was only after air pressure had been pumped in that the men in the bore could work with any degree of safety or success.

The job is a small section of Seattle's great North Trunk Sewer, a system extending from Lake Washington, the body of fresh water bounding the city on the east, to Puget Sound, salt water, on the west. The big trunk sewer, which will cost $4,000,000, involves much tunneling, some of it dangerous, but none of it can compare in danger, discouragement and vexation with the little Ravenna hill bore.

Imagine trying to bore a tunnel through a bowl of soup and you can picture the troubles of the contractor who is driving the hole through Ravenna hill. Down in the 6-ft. bore, drenched by a blinding downpour of water which leaks through the lagging overhead, the tunnel crew works shoulder to shoulder with death in half a dozen forms. Sometimes it is a heavy timber at the head of the bore which cracks and breaks with a reverberating report. Sometimes it is a post being driven into the floor or a lagging driven into the breast of the tunnel that pierces a pocket of water and drives the men, like rats, to seek shelter in the air gate. Sometimes before timbers can be placed the ooze pours out on them in a strangling, sticky mass.

An idea of the nature of the task can be gained from the fact that the average day's "drive" is 7 ft. and at times the workers have toiled 24 hours and added a foot and a half to the distance covered.

A hundred and twenty-five feet above the bore a woman had a house built and a cement floor put in her cellar. So porous is the hill that the imprisoned air in the bore below rushed up and split the newly laid floor with a million tiny cracks.

The tunnel is dug largely by bare hands. The breast is planked up stoutly, with merely a large enough hole in the planking for a man to reach in his arm and scoop out the muck. When a hole is started, lagging is driven in overhead. Then a plank is removed and the hole enlarged. Later one and then two workmen crawl in and enlarge the cavity until the plank shield can be advanced a few feet.

The rest of the North Trunk Sewer job is making excellent progress through hard clay and sand. Apparently nature has picked the Ravenna hill portion as the battleground for her hand to hand struggle with the human moles.

INDIAN MILL IN NEW MEXICO

This square log structure is an Indian mill on a reservation near Santa Fe, New Mexico. It is run by water power, the wheel being 24 in. in diameter, mounted on an upright shaft in direct connection with the burr that does the grinding. The capacity of the outfit is about one-half bushel per hour.

SHOP NOTES

Emergency Repair Outfit for Motorboats

The following outfit of repairs should be carried on every motorboat and yacht. A leak that would sink a boat in a few minutes can be quickly repaired if the necessary tools and materials are at hand. The outfit should contain the following articles:

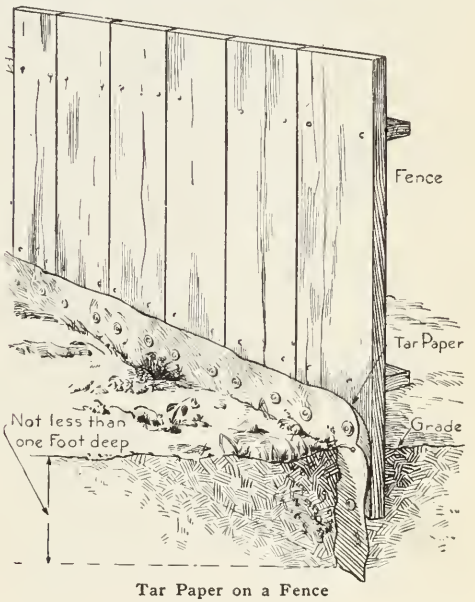
2 yd. heavy canvas.
5 lb. oakum.
5 lb. mutton tallow.
2 lb. shingle nails.
1 package of large carpet tacks.
1 piece of pine, ½ by 12 by 18 in.
1 piece of pine, ¼ by 12 by 18 in.
1 sharp hatchet.

Carry the lumber, oakum and canvas in the shape of a cushion with the two boards as a base and the oakum on top. The canvas wrapped around the whole will form a cover. It should be slightly fastened with a string so it can be easily opened in case of accident.

Place the hatchet, tallow, tacks, nails and canvas cushion where they may be easily found. Should the boat spring a leak or be snagged below the water line, cut away the ceiling, flooring or whatever is necessary to reach the hole from the inside, then place a "soft patch" over the opening. Cut a piece of the ½-in. board the right size to cover it. On one side of the board tack two thicknesses of canvas, and, if the canvas and board will not fit flat against the planking and make a tight-fitting cover, place oakum between the canvas and the board, and nail the patch over the hole. If the hole can be reached from the outside, insert oakum and daub it over thoroughly with tallow. If the hole is small it can be stopped with oakum and tallow until the soft patch can be prepared. If the hole is large use a pillow or piece of blanket. Should the hole be above or just at the water line, tack a good sized patch of canvas on the outside of the hull, using battens made of the ¼-in. board, fastening them with the shingle nails.—Contributed by John P. Cowing, Chicago.

Tar Paper Keeps Out Vermin

A cheap way to keep rats, mice and ants from gnawing their way through a wall or fence is to tack some tar



Tar Paper on a Fence

paper on the place where they are liable to enter. If it is a solid board fence put the paper on the bottom and let it extend into the ground, as shown in the illustration. This class of vermin will not gnaw through anything saturated with tar. The tar paper can be used to keep out most vermin in addition to the advantages of waterproofing and preserving the wood.—Contributed by A. P. Connor, Washington, District of Columbia.

Combination Hinged and Roller Doors for a Garage

The owner of a private garage wished to have the doors so arranged

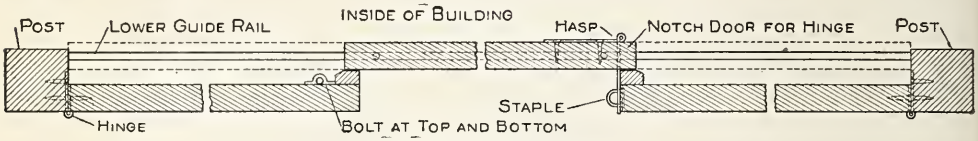


Fig. 1—Three Doors on a Garage

that he could open two-thirds of the front at once and on either side. This required three doors, and as there was no chance to slide all of them, two were hinged and one made to slide, as shown in Fig. 1. The middle and inside door was hung on an overhead track and could slide to either side of the opening. The two outside doors were fastened with hinges to the posts as shown. An inverted trolley track was placed in the cement floor under the middle door as shown in Fig. 2. Two lag screws were screwed into the bottom of the door and their heads cut off, leaving the stem projecting about 1 in. The door was then hung with these pins in the slot of the trolley track, and the result was a door that would slide freely in either direction, yet was held firmly from swinging in or out. One hinged door was provided with top and bottom bolts on the inside as shown. The middle door had a hinged hasp attached that would fit over a staple in the other door. By means of this arrangement the doors could be locked with a padlock from the outside. When one side was to be opened the sliding door was pushed over a hinged door and the opposite one swung open.—Contributed by E. E. Harriman, Los Angeles, Cal.

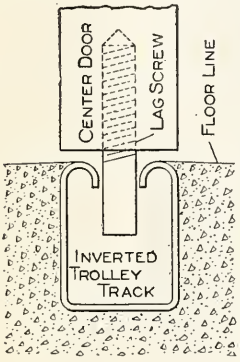
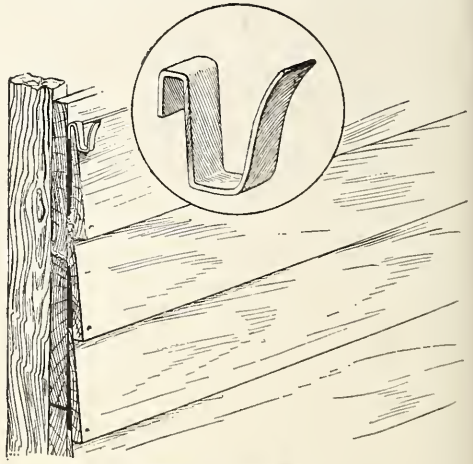


Fig. 2

Hooks for Holding Siding While Nailing

When placing on long lengths of siding or weather-board a carpenter finds it necessary to supply some sort of support for the one end while he marks the other for sawing to length. The most common method of obtaining this support is to temporarily drive a nail into the last board put on and allow it to project far enough for the next board to rest upon. As fast as a board is nailed in place the nails which acted as its temporary support must be withdrawn and moved up the width of one board. This procedure not only takes considerable time, but unless extreme care is used, one is liable to crack quite a few boards, since the temporary nail must be driven at a point where the board is not very solidly backed.

A convenient substitute for the above



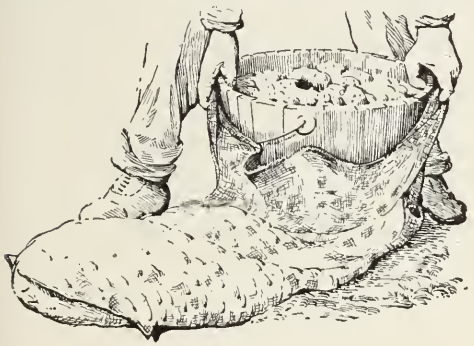
Method of Using Hook

method is to use two hooks as shown in the accompanying sketch. These may be made from the metal strips found on every bunch of shingles, but are preferably made from spring steel,

if one expects to have very much use for them. The dimensions of the hooks are made to suit the lap desired. It will be found that it is much easier to move the hooks up as the work proceeds than it is to drive and pull the nails as is customary.—Contributed by M. R. Wells, Racine, Wis.

One-Man Bag Filler

It very often happens that one wishes to fill sacks with small grain, apples, potatoes, etc., but has no one to help hold the bag. An excellent method of doing this is to procure an old wooden or metal bucket and knock out the bottom. If it is a metal bucket, file the

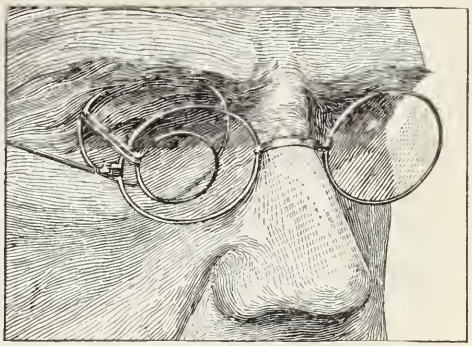


Bucket Without a Bottom

edges smooth to prevent its tearing the bag. Set the bucket in the mouth of the bag as shown in the illustration and you will have no trouble in filling it. —Contributed by D. J. Tancik, Lyons, Iowa.

Extracting Small Slivers

Frequently a workman is unfortunate enough to get small slivers of wood or steel or iron into the flesh and have them break off level with the surface of the skin. These little slivers are often too small to be seen with the naked eye and are therefore very difficult to remove. They are very painful and a cause of much annoyance, but if the workman has a small folding pocket magnifying glass as shown in the accompanying sketch his troubles are



Microscope Used with Eye Glasses

soon over. This little magnifier can be used with glasses as well as without and can be folded up and kept in a small leather case to prevent its being broken. Every machinist should own one as it would be the means of preventing a great deal of discomfort.

Refrigerator Made of a Barrel

An inexpensive refrigerator can be made by using a water-tight barrel, on the inside of which is placed a metal box, supported on a stand set on the bottom of the barrel. A hinged door is supplied to cover the opening. The metal box can be made of heavy tin or galvanized sheet iron, well soldered along the seams. The barrel is then filled about the metal box with coarse gravel, leaving room at the top for the ice. The metal box with the support and board for holding the ice is shown

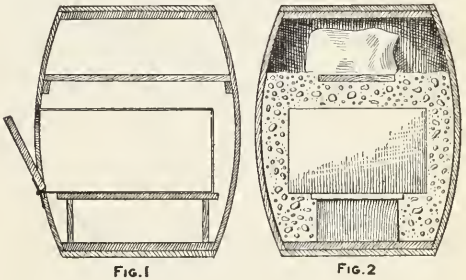


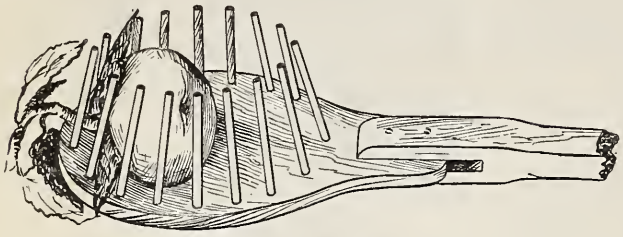
FIG. 1 FIG. 2

Barrel Refrigerator

in Fig. 1, and the completed ice box in Fig. 2. A hole must be bored in the bottom of the barrel to drain out the water.—Contributed by C. C. Brabant, Alpena, Mich.

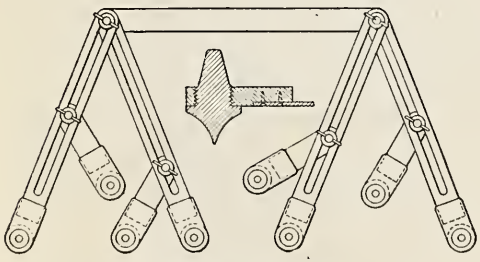
Tool for Transferring Holes

Machinists and repairmen often have occasion to transfer a set of holes from one piece of metal to another, a difficult



Fruit in the Picker

task unless one has the proper templets. The little tool shown in the accompanying sketch was devised for this work and has proven very satisfactory. Simply loosen the thumb-nuts and let the different points and arms conform themselves to whatever position the holes may be in, tighten the nuts, set the instrument on the work with the sharp points down, and tap each one a slight blow with the hammer. If the end points are marked first they will tend to hold the tool in place while the others are being marked. It is a universal tool as it can be used for any number of holes up to eight at one time. The small sketch in the center



Details of the Templet

shows the detail construction of the punches and end plates. The points of the punches should be hardened.—Contributed by C. G. Smith, Brooklyn, New York.

¶Reverse the flow of electric current periodically to reduce the wear on vibrator points.

A Fruit Picker

Scattered fruit on a tree is hard to pick by climbing a ladder. If the fruit is shaken off, the fall will cause bruises that make it unfit for storage or shipping. I devised the picker shown in the accompanying sketch to remove the fruit growing on the ends of branches and in places not easily accessible.

The device consists of a long handle to which is attached a board having pegs 9 in. long fastened in a circle, and set so that their ends incline toward the center. The stem will slip through between the pegs and the fruit can be easily pulled off and retained by the pegs.—Contributed by E. H. Nahm, Cleveland, O.

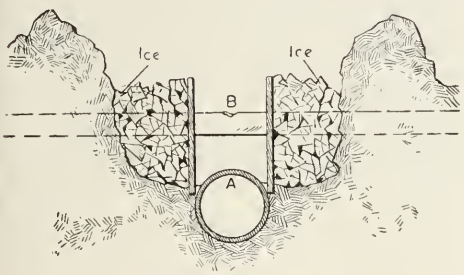
Drilling Holes Half in Cast Iron and Half in Steel

Anyone who has tried to drill holes half in cast iron and half in steel knows how difficult it is to keep the hole exactly divided between the two metals. A case of this kind is where a cast-iron wheel is held on the end of a shaft with a round key. Cast iron being much less dense than steel, and containing numerous small holes, induces a drill, no matter how well started, to follow the law of least resistance, and if the hole is deep enough it will surely end up entirely in the cast iron. A good way to overcome this is to chip, file or plane in the steel piece a slot as long as the length of the hole to be drilled. In size make it about one-third the area of the final half hole in the steel. Then assemble the two pieces and start the hole half and half, and you will end up with a very nearly straight hole. This slot, which reduces the amount of steel to be removed by the drill, offsets, or rather balances the lighter structure of the cast iron and has this effect for the whole depth of the hole.—Contributed by D. Hampson, Middletown, N. Y.

Freezing Water in a Main to Make Repairs

In removing an old water main the workman doing the digging accidentally hit a lead pipe which branched from the new main, making a hole from which the water flowed quite freely. As it was impossible to shut the water off, a difficult problem presented itself as to how the leak could be stopped and the pipe repaired.

In the accompanying sketch A shows the main that was being removed and B shows the break in the lead pipe where the workman pierced it with a pick. Ice and salt were packed around the pipe which slowly froze the water within and stopped the flow. This enabled the men to solder up the hole,

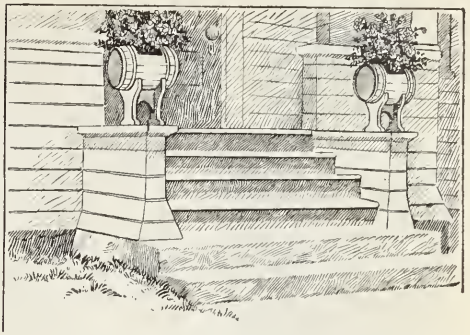


Freezing the Water Main

after which the ice was removed and the frozen water allowed to thaw.—Contributed by Frank L. Walter, Dayton, Ohio.

Turning Polished Nuts

Almost all machines are made with some nuts or bolt heads finished "bright" or highly polished, and to set them up tight and not mar the surfaces calls for more than an ordinary monkey wrench. A special socket head must be made to fit the head close and used with an ordinary wrench in turning a nut. Where only a few bolts or nuts are to be tightened, take a strip of heavy tin or zinc and bend it to the shape of the nut to take the place of the special socket head. The jaws of the wrench should be perfectly parallel and set up as close as possible.



Casks Now Hold Flowers Instead of Water

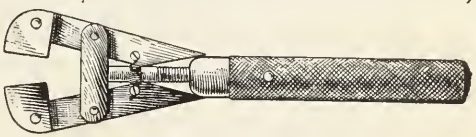
Jardinieres Made of Water Casks

This pair of attractive porch ornaments can be easily duplicated by any handy man who can find a couple of small kegs and some bits of boards.

The ones shown in the illustration are little oaken water casks with oval heads which set on a little rack, such as are used on shipboard. The bunghole was enlarged with a key-hole saw to a diameter of 5 in., then the improvised flower pots were filled with earth and plants set in. A couple of coats of paint add to their appearance.

Hand Vise

A neat and serviceable little hand vise that will be found very useful in the workshop is shown in the accompanying illustration. The jaws are loose on the pins and have a spring at the back which allows them to open parallel. The jaws are also held open at all times by means of this spring. They will hold a tapered piece of work as well as a straight piece and readily adapt themselves to fit any odd shape. They are adjusted by turning the handle, which moves the threaded rod,



Machinists Hand Vise

fastened to the crosspiece, in or out, as the case may be, thereby opening or closing the jaws.—Contributed by Robert Stewart, Hartford, Conn.

A Rain Gauge

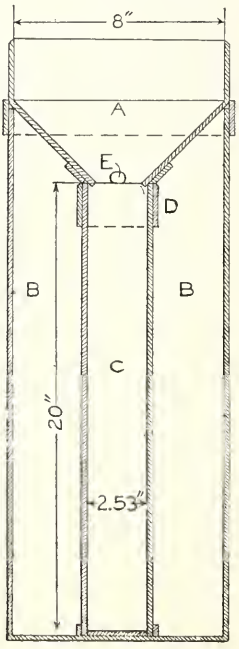
By SAMUEL K. PEARSON, JR.

Rainfall is measured on the basis of the depth of water which would accumulate on a perfectly level surface provided all of it remained as deposited without loss by absorption, "run off" or evaporation. The instruments used to determine the depths of the fall, most commonly known as rain gauges, are neither well known by sight nor is the method by which they record the rainfall perfectly understood by the general public. With such a gauge an amount as small as 1/100 in. may be measured without difficulty.

Rain gauges are composed of three parts: the receiver, A, the overflow attachment, B, and the measuring tube, C. Those used by the United States Weather Bureau are of the type shown in the accompanying illustration. The top portion of the receiver A is 8 in. in diameter inside, which has a funnel-shaped bottom to carry the rainfall caught into the long narrow cylindrical measuring tube C. The height of the measuring tube inside is 20 in., with a diameter of 2.53 in. As the area of the receiver is greater than the area of the measuring tube, a small portion of rainfall will show quite a depth which is easily measured. The amount shown in the measuring tube is 10 to 1. For example: an actual rainfall of 1 in. taken in the large receiver would measure 10 in. in the measuring tube, while an actual fall of 1/100 in. would produce 1/10 in. in the tube. The depth of water in the measuring tube is obtained by inserting a narrow stick or ruler graduated in inches and tenths of inches.

The measuring tube will hold 20 in. of water or 2 in. actual rainfall. Such an amount is considered a heavy fall, but for the measurement of excessive falls of rain the sleeve D of the funnel receiver fitting closely over the top of the measuring tube is provided with a little opening, E, on the same level with the top of the tube, so that the excess water will escape through this opening into the large overflow attachment, B. The surplus water caught in B can be poured into the measuring tube and the amount added to the 2 in. which filled the tube to the brim.

During the winter months both the receiver and the measuring tube are removed from the gauge so that precipitation falling in the form of snow or sleet may be caught in the receptacle. The snow is then reduced to water and poured into the measuring tube and its depth obtained by the same method as rainfall. A record of the depth of snowfall unmelted is also observed and recorded, and it is usually found that its equivalent in water is 10 to 1, that is, 10 in. of moderately moist snow will produce, when melted, 1 in. of water. Frequently it will yield a much lessser or greater amount of water, according to the quality of the snow, whether of a



light and dry, or heavy and moist character.

The regular stations of the weather bureau use an electrical recording gauge, equipped with a small tipping bucket below the funnel, which tips when filled with each 1/100 in. of rainfall, and records each tip upon a chart. Thus the amount of rainfall is measured by the number of tips which can be recorded at any distance from the gauge.

Speed of a Shaft Found Without an Indicator

Having occasion to take the speed of a line shaft, and finding that I had left my speed indicator at the office, I used the following method which may be of service to others in the same predicament.

Simply strike the end of a shaft with a hammer, as shown in Fig. 1, hard enough to make a small dent or depression on the edge. Hold your finger on the edge, guiding it with the thumb as shown in Fig. 2. The depression, A, is easily felt as it travels under the

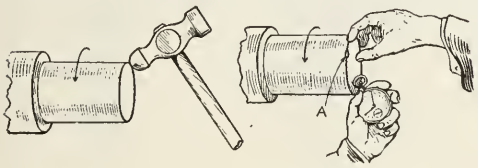


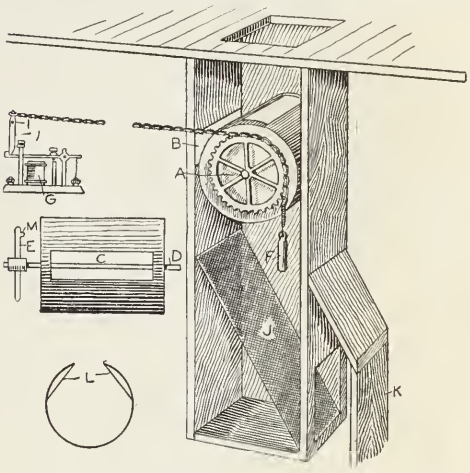
FIG. 1 FIG. 2

Finding the Speed of a Shaft

finger, and in this way the speed of shafts running as high as 300 to 400 r. p. m., may be more accurately taken than with any indicator except the most expensive ones with automatic stops.—Contributed by E. W. Davis, Chicago.

Automatic Horse Feeder

A simple and easily constructed device for feeding a horse his grain at noon when no one is about is shown in the accompanying detail sketches. The chute opens through the floor into the grain bin above, and is drawn with the end board removed in order to better show the arrangement of the drum. A drum having a diameter the same size as the width of the chute, is fitted into it and revolves on the axle D,



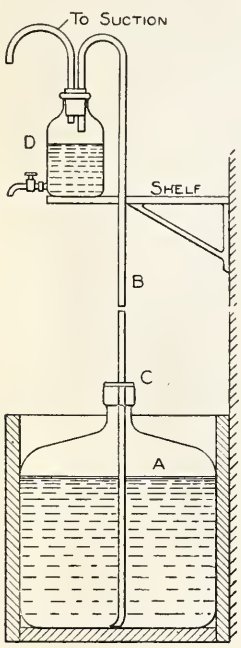
Feeder Operated by Electricity

to which it is securely fastened. It is provided with a slot, C, for the grain to pass in and out. The axle projects at one end and to this is fastened an ordinary bicycle sprocket wheel as shown. A lug, M, fastened on a spoke of the sprocket wheel, allows the drum to turn only half way around. This is an important feature of the device. A bicycle chain with a weight, F, at one end, is hung over the wheel as shown and the other end is fastened over the end of the small lever. This lever works on a pivot, I, and is released by means of the telegraph sounders, thus letting the chain slip off. When released the weight turns the drum and empties the grain. The telegraph sounder gets its electrical connection from an alarm clock in the home. As the grain is dumped from the drum it falls on the screen, J, thence into the chute, K, and drops into the feed box below. A couple of flash tins, arranged in the drum as shown at L, will help to empty the drum completely.—Contributed by C. G. Smith, Brooklyn, N. Y.

¶Always put a washer on a lag-screw before turning it into the wood.

A Convenient Method for Handling Acids

The device shown in the accompanying sketch is simple and inexpensive, and its advantages are many. Nothing but glass comes into contact with the acid, no fumes escape into the air. The carboy is not subjected to pressure, nor is it necessary to move it, thus obviating all danger of splashing, etc., says a correspondent of the Chemical Engineer.



The figure is self-explanatory. A is the carboy, B a glass tube ¼ in. in diameter, bent at the lower end so that the bottom of the acid may be reached, C is a loose cover of sheet packing, to keep dust out of the carboy; D is a 2-liter bottle, closed with a 2-hole stopper. The tube B passes through one hole, and a short bent tube through the other, to which is connected, by means of a rubber tube, a suction or filter pump.

On starting the pump a partial vacuum is created in the bottle and the acid flows into it. To stop the flow it is only necessary to disconnect from the pump. By using an aspirator bottle with a glass stopcock at the bottom, the apparatus may be made permanent and need not be disturbed until the carboy is empty.

¶Automobile oil lamps should be emptied and boiled in water once a month. This will remove all dirt and prevent them going out when in use.

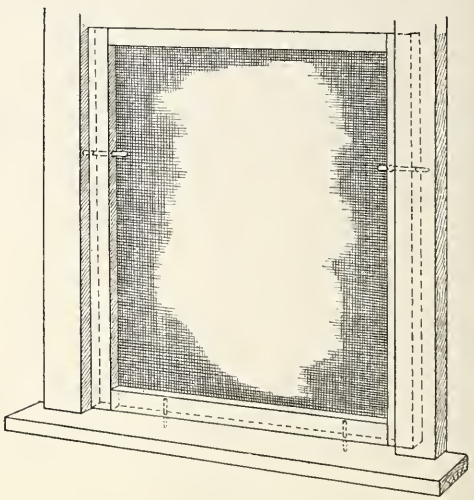
Repairing Leak in Water Leg of Fire Box Boiler

Fill the water leg with a mixture of two parts cement and one part sand so as to cover the leak, and allow to stand over night. When repaired in this manner the boiler can be used for months, if necessary, or until permanent repairs can be made.

Government boiler inspectors have allowed such repairs, made on marine boilers, until the boat could be laid up for repairs or went into winter quarters, where the leak was so bad that it could not be patched, except by putting in new sheets.—Contributed by J. P. Cowing, Chicago.

Fastening a Screen Frame in a Window

A simple way to fasten screen frames in windows is to cut off the heads of two wire nails and use them for pins in the bottom piece of the frame. Bore small holes in the sill to receive the pins. Use two old-fashioned spring



Screen in Place

window stops for the sides. The screen can be put in and taken out quickly.—Contributed by F. D. Heiser, Biddeford, Maine.

¶Never change a single ball in a bearing. Renew them all.

Home-Made Door Knobs

A substitute door knob can be quickly made in the following manner: Take the unbroken knob, imbed it in some soft clay, and make a hole around the bolt so the metal can be easily removed. After the clay is well pressed together, as shown in Fig. 1, it is cut in two with a thin sharp blade of a knife. The knob is then removed, leaving a perfect clay mold in halves, as shown in Fig. 2. Fill the lower half of the mold with a neat mixture of cement. Place the bolt taken from the broken knob in the hole made in the other half of the mold and fill it with cement well packed around the metal bolt. Then place both halves of the mold together and set aside until the cement hardens. It is best to remove the knob from the mold before it is too hard and paint the surface over with a very soft mixture of cement to fill all

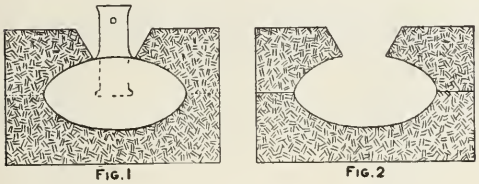


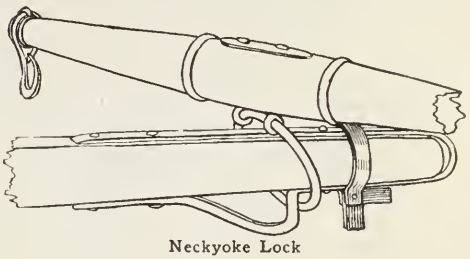
FIG. 1 FIG. 2

Clay Molds

holes. The knob can be smoothed up with fine sandpaper before the cement has set hard. If a coat of enamel is applied the cement knob cannot be detected from the original porcelain knob.—Contributed by C. C. Brabant, Alpena, Mich.

Holding the Neckyoke on a Tongue

The little device illustrated herewith, when applied to the end of a vehicle tongue, prevents the neckyoke from slipping off and may thus avert a disastrous runaway. It is made by bending a piece of ½-in. rod, about 4 in. long, at right angles and drilling a hole through it in the bend. This is attached to the under side of the tongue by an iron strap, fastened around the wood so that the rear angle hangs down and the forward angle lies parallel with the tongue. When the ring of the neckyoke is passing over the end of the tongue the lock is tilted forward



Neckyoke Lock

and then drops back in position as shown, after the ring is in place.—Contributed by Thos. L. Parker, Olaf, Iowa.

Paint Brush Hangers

Proper attention should be given to paint brushes, while in use as well as when laid aside. Two small clips made of tin or galvanized iron, and fastened to one side of each brush, as shown in Fig. 1, will provide a means to keep it from slipping into the paint pot. The brush can be hung on the side of the paint pot as shown in Fig 2. This will allow the paint to drain in the pot when the brush is not in use, and will also keep the bristles straight and prevent

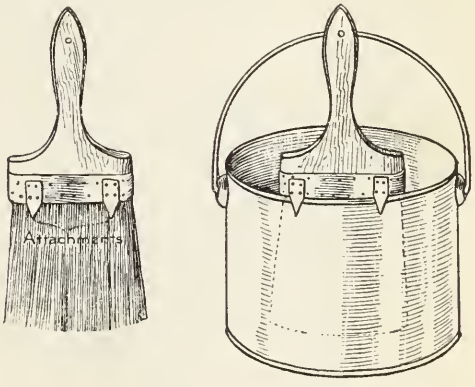


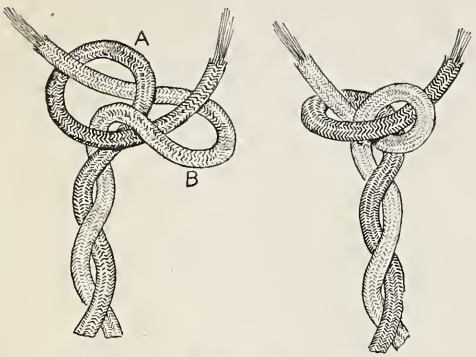
FIG. 1 FIG. 2

Clips on Paint Brushes

them from bending out of shape as they would if the brush were allowed to rest on the bottom.—Contributed by W. A. Jaquythe, Richmond, Calif.

A Knot for Flexible Lamp Cord

A knot that pulls tight and lays almost flat like a washer slipped over the cord is valuable in wiring up lamp

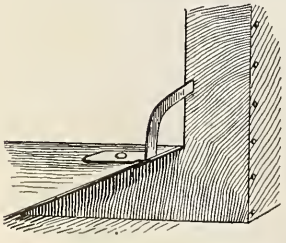


A Flat Knot

sockets and ceiling rosettes. Such a knot is made by turning cord A back in a loop, then turning the cord B back over A, passing the end under and through the loop A and then pulling tight. If the tie was not made in the right place it will come loose instantly by pushing on the cord.—Contributed by C. W. Goddard, Bellaire, Mich.

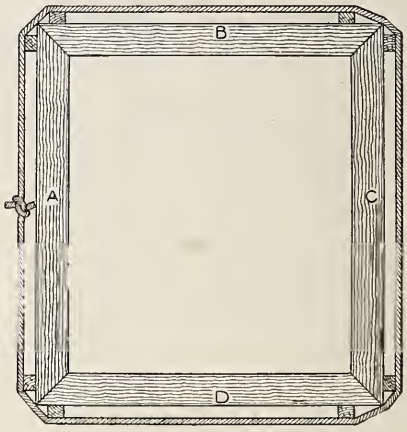
Oven Door Catch

Most oven doors are provided with a spring of some sort to overcome the jar of falling when opened. This spring often causes the door to rebound 3 or 4 in., and if the housewife is not careful the door will strike her arm as she reaches into the oven, and cause a bad burn. This rebound can be prevented if a small flat spring is bent and attached to the door with a stove bolt as shown in the accompanying sketch. When the door is down the end of the spring catches on the edge of the door frame, thus preventing its rebound. To close the door, simply press in on the spring and it will slide along the side of the oven as the door is closed. This little device will prevent many burns and is well worth the time and trouble it takes to make and attach it to the door.—Contributed by Carl P. Herd, Davenport, Iowa.



Method of Gluing Mitered Frame Joints

Have the miters cut perfectly true, then place the frame on a flat table with the miters in their proper positions. Place paper under the joints to keep them from sticking to the table while the glue is drying. Apply the glue to the miters and bring them as close together as possible. Tie a heavy cord about the frame as shown in the accompanying sketch. A trunk strap will do as well. Place eight small blocks of wood under the cord at the



Clamping the Frame

points marked A, B, C, and D, and push them towards the corners of the frame. This will tighten the cord and draw the miters firmly together. Leave in this position until dry, then remove the cord and drive nails across the corners, if necessary.—Contributed by G. B. Benford, Fair Haven, Vt.

¶Apply a coat of starch water on a dirty wall before painting. When dry the dirt and starch can be brushed or wiped off.

Home-Made Power-Driven Lawn Mower

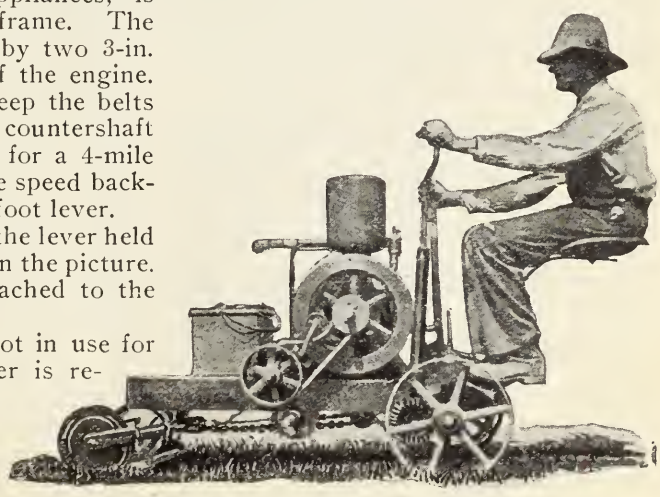
The accompanying half tone shows a machine, a home-made affair, which was constructed to drive a lawn mower, yet it can be used for various other purposes. The frame of the machine is 4 in. thick, 13 in. wide and 4 ft. long, made of hard wood. The driving axle is 2 ft. long, thus making the track 2 ft. wide. The rear wheels are 16 in. in diameter, the face of each being 4 in. wide. Only one wheel is provided with lugs for traction, so in turning a curve the smooth face can slip. No differential is provided, as it is not necessary on such a light rig.

The lawn mower is attached to the front of the main frame similar to the fifth wheel on a buggy. The handle was removed from a common 18-in. lawn mower and an arch made from 1-in. pipe to fit in its place. This arch fastens on the outside of the wheels as shown in the illustration, using the same bolt that holds the wheels on the mower. There is a 1¼-in. tee placed in the center of the arch in which is screwed a short piece of 1-in. pipe to serve as a king bolt. The latter piece of pipe passes through a hole bored in the front end of the main frame, thus forming the fifth wheel of the machine.

A 1½-hp. gasoline engine, weighing 250 lb. with all its appliances, is mounted on the main frame. The whole machine is driven by two 3-in. belts, one on each side of the engine. Two idlers are used to keep the belts taut. The belts drive a countershaft which has a sliding gear for a 4-mile speed forward and a 3-mile speed backward, both operated by a foot lever.

The guiding is done by the lever held in the left hand as shown in the picture. The guiding chain is attached to the lower end of this lever.

When the machine is not in use for cutting grass, the mower is removed and a two-wheeled axle put in its place. The wheels on this axle have a 2-in. face and a diameter of 12 in. The axle is made of 1-in. pipe, 2 ft. long. The wheels have a band placed on the center of their faces to keep them from slipping when making turns. The engine can be used for sawing wood, grinding feed or running a washing machine.—Contributed by Herman A. Grimund, Bristol, Ill.



Gasoline Engine Driving Lawn Mower

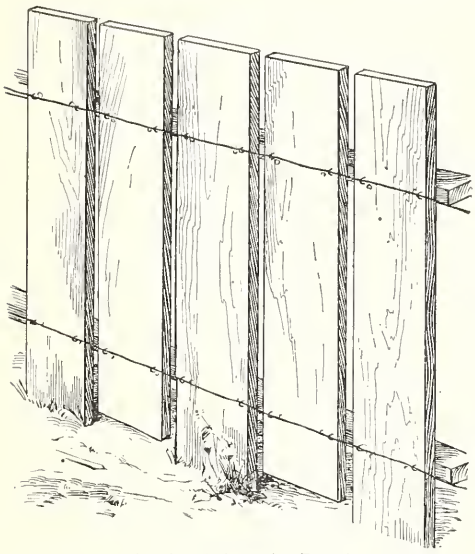
A Home-Made Garden Weeder

A home-made hand weeder for use about the garden is shown in the accompanying sketch. Grass and weeds can be quickly and easily cut or combed from about small plants by means of the sharp saw teeth. The end can be used as an individual weeder, trowel, or transplanter. It is made of a piece of steel of about the thickness of a garden trowel and 1 in. wide. Bend it and attach a handle, then file or grind in the sharp teeth as shown.—Contributed by W. A. Jaquythe, Richmond, Cal.

Saw Tooth Weeder

Holding Boards on a Fence

A board fence soon goes to rack and ruin after one or more boards fall from place. A large company having

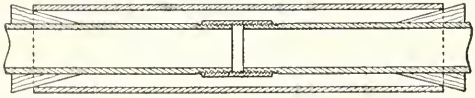


Wire Stapled to the Boards

branches in several cities, keeps its merchandise in enclosures fenced in with boards nailed perpendicularly on cross bars between posts. To prevent any boards from falling should they become loose, the company have adopted the plan shown in the sketch. A wire is stretched and fastened with staples driven in each board on the side opposite the crosspieces.—Contributed by J. J. O'Brien, Buffalo, N. Y.

Reinforcing Pipe Lines at the Joints

The scheme shown in the accompanying sketch will be of service to those who have occasion to connect



Prevents Binding at the Joints

up a pipe line across a stream or space when it is necessary to connect up the line before it is put in place.

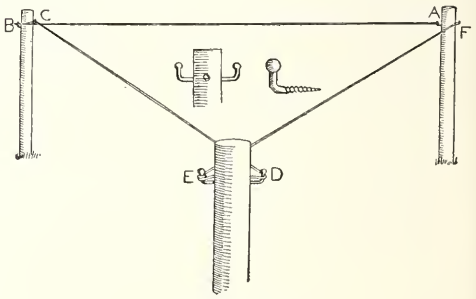
A piece of pipe somewhat larger than the pipe being connected is slipped over the line at each joint. After the joints are screwed together tightly, wedges with long tapers are driven between the pipes in such a manner that the tendency to bend in the joints will be prevented by the sleeve before the connection loosens with the strain.—Contributed by J. H. Cruger, Cape May City, N. J.

How to Utilize Old and Thick Paint

To utilize old and thick paint when a paint grinding mill is not at hand, grind the paint through an old meat cutter, using the nut butter grinder. Thin it with turpentine and oil. In this manner all accumulated leavings in paint cans can be used.—Contributed by J. P. Cowing, Chicago.

Post Hooks for a Clothesline

Secure several ½-in. lag screws, 5 in. long, forge the square head in the shape of a round knob, as shown in the small, center sketch, and bend the end up. Each post must be provided with two of these hooks, one opposite the



Clothesline Hooks

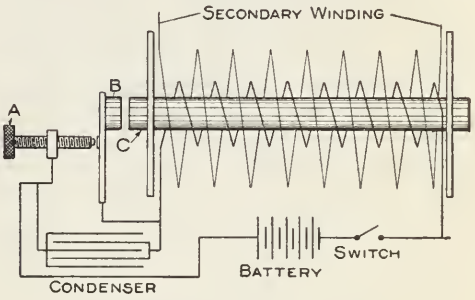
other, at the top end. One end of the rope is fastened at A, drawn taut around the hook C, thence to B and across to D, from D to E, E to F, and then tied.

¶Sprinkle unslaked lime along the comb of a roof, and the rain will dissolve it and carry it over the shingled surface, thus removing moss and accumulations of dirt.

How to Adjust a Spark Coil

Standard makes of spark or induction coils, when properly adjusted, consume nearly one-half ampere to each engine cylinder. If the contact points are screwed together too close, the current consumption will be increased with a less mileage than can be secured with the same battery with the coil properly adjusted. It is advisable in every case to adjust the coil until it will take no more current than is necessary. To do this use the ammeter either connected in the place left for the connection on the coil, or into the battery connection, so the current will flow from the battery through the ammeter to the coil. If the coil has a number of units intended for use with a multiple cylinder motor, place a piece of paper under all except one of the points while the engine is running. Adjust this point until the current taken is a minimum, without any tendency to miss explosions. If the engine will not run on the one cylinder, the current taken by each of the points may be determined by blocking this one point off with a piece of paper and noting the change in the current taken. It may be necessary to go over the operation a number of times to find the lowest consumption on which the engine will run properly. In most cases the coil vibrator will not need adjusting.

The method of construction of a spark coil is shown in the accompanying sketch. If its principles are thoroughly understood, its adjustment will prove quite simple. When the adjusting screw A is turned inward, forcing the vibrator B nearer the pole or core C, the rate of vibration will be increased, and when the screw is turned outward the rate of vibration is decreased. However, there are definite limits to the proper operation of the core C, at either loose or tight adjustments. The adjustment that would prove suitable for low speeds, may be very unsuitable for high speeds and vice versa. This may be applied to the strong and weak batteries. Therefore, when possible, it is advisable to attend to the battery rather than the coil adjustments. When the jump spark coil



Induction Coil with Condenser

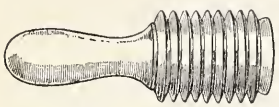
is used it is advisable to have two sets of batteries controlled by a two-point switch. The vibrator B should vibrate with a rapidity sufficient to give a clear musical sound. Rapid vibration, except of course one that is excessive, will be much better for the battery than one that is slower. When the rate of vibration is reduced it increases to a certain extent the efficiency of a weak battery, as this allows time for the current to more fully saturate the windings of the coil. The vibrator should buzz only at the closing of the primary winding or circuit when the contact is made at the points of the commutator.

The object of the condenser is to reduce the sparks at the points of the primary winding and to generate them in the secondary winding much more brilliant and intense.

In selecting a coil it is necessary to see that it is suited to the type of battery or generator with which it is to be used. The best results cannot be obtained unless the coil and source are mutually suited to each other. This rule will hold good for all types of generated current, but is particularly true if the small dynamo is used in place of batteries.—Contributed by J. N. Bagley, Webber, Kan.

Home-Made Steak-Beater

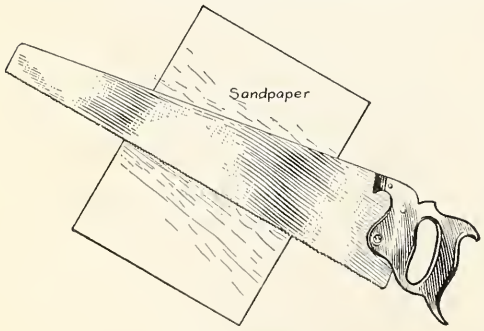
I had a job to turn out a steak-beater on my lathe for a customer, and it looked good to me; so I experimented a little, turnning out quite a number of them in different woods. The size adopted as the best is 3 in. in diameter and 8¾ in. long over all. The diameter at the depth of the grooves is 2⅜ in. The width of each groove from point to point is ⅜ in., with the end turned off rounding ½ in. long. The handle is 1¼ in. in diameter at the smallest place and 1⅝ in. near the end.



The beater should be turned from close-grained, well-seasoned wood. Hickory, pecan, osage orange and beech are good. Cut the grooves about the same angle as a V-thread. The end can be used as a potato masher.—Contributed by J. W. Brelsford, Houston, Texas.

Tearing and Folding Sandpaper for Use

Sandpaper can be torn quite easily by placing it under a fine-toothed saw, with the sand side down, and tearing up as shown in the accompanying sketch. This does not damage the saw

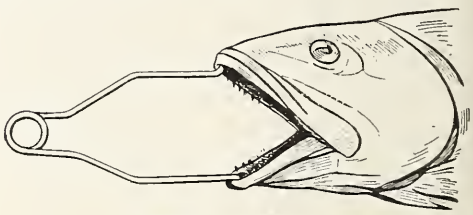


Tearing Sandpaper

and the sheets can be torn to any desired size convenient for use. If the paper is folded four double, better service can be had from it than by using it in single sheets. By thus folding two sides can be used and when worn, the two unused sides can be turned out. If the smooth side of the paper is chalked before it is folded it will prevent its slipping when in use.—Contributed by C. Purdy, Ghent, O.

Removing a Hook from the Mouth of a Fish

Fishermen who have trouble keeping the mouth of a fish open while removing the hook, will be interested in the little device shown in the accompanying sketch. The spring shown will do the work very nicely and the hook can be easily removed with a disgorger, thus saving many broken lines and cut fingers. This device is especially useful to the ladies who enjoy fishing, but dislike the operation of removing the hook.—Contributed by F. S. Cummings, Detroit, Mich.



Spring in the Mouth

Cutting Oil Grooves

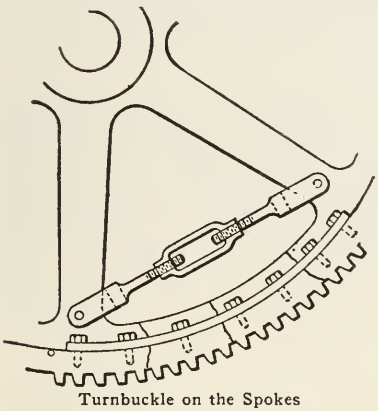
For some classes of work the ordinary oil groove is undesirable. For instance, a tight belt running down from a countershaft exerts a considerable pull on the upper bearing and a liberal oil groove, cut straight across the top, lessens the wearing surface, and hastens a renewal. However, plentiful lubrication must be provided for in some manner. A good way to cut oil grooves is to chuck the bearing, and with a boring tool having a round point cut a thread right through the box. The thread should be of a coarse pitch, say, ½ to 2 threads per inch, depending on the size of the bearing. Right and left threads can be cut, if

desired, in the same bearing, each starting from the oil hole and so cut that the oil will follow around the box when the shaft revolves.

An Emergency Gear Repair

The accompanying sketch shows a quick repair job of a spur gear. This gear is one of a series of drier gears on a large paper machine. The gear broke one day about 1:30 a. m., and at 6 a. m. the paper machine was again doing business, says a correspondent of the American Machinist.

It seems the company had no extra gears in stock, so the master mechanic was called in to repair the gear. He found two old steam-pump valve-rod heads and a turnbuckle which he arranged as shown in the sketch. While he was doing this the other men were

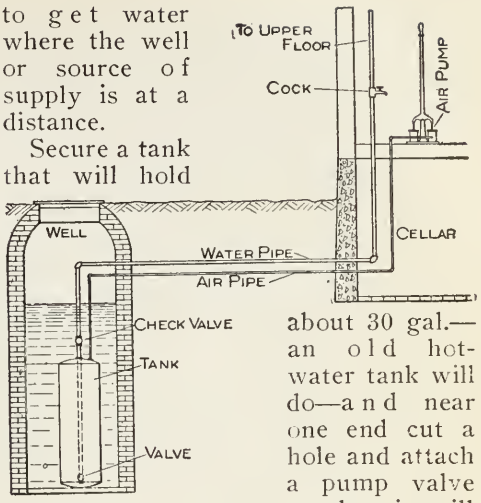


Turnbuckle on the Spokes

drilling and tapping the holes in the rim of the gear, also forming the straps, one on either side. These were bolted fast, then the turnbuckle screwed up, and the repair was complete. This repaired gear has been in use for two years and is still doing good work.

Home-Made Pneumatic Water System

A simple and inexpensive installation of a pneumatic water supply system for country homes is shown in the accompanying sketch. In cold and stormy weather it is a great convenience, as it is not necessary to leave the house to get water where the well or source of supply is at a distance.

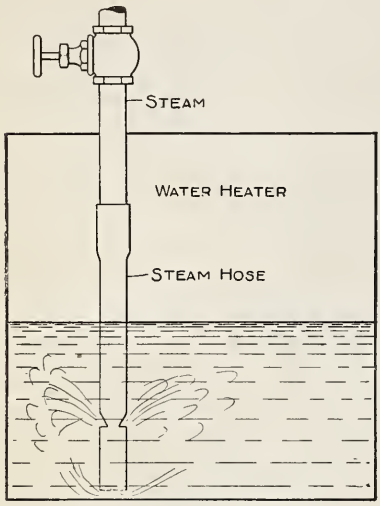


Secure a tank that will hold about 30 gal.—an old hot-water tank will do—and near one end cut a hole and attach a pump valve so that it will let the water into the tank, but close when it has a back pressure. This tank is to be set upright in the well, with this valve near the bottom as shown in the sketch. The supply pipe should be put into the tank and run to within about 1 in. of the bottom. A check valve is put on the pipe near the tank, then the connection made to the house. The water pipe should be underground and deep enough to prevent freezing in cold weather. Now attach a ⅜-in. air pipe as shown and connect it to an air pump in the house. An old bicycle pump will do if you have nothing better. A valve is attached to the pump so the air can be let off when necessary.

The tank, being under water, fills itself as soon as the air valve is opened. When it is full the valve is closed and a pressure put upon the water by means of the pump. This pressure forces the water through the supply pipe into the house, where it can be drawn off through taps as wanted. When the tank is empty it is filled again by letting the air pressure off at the air valve. When full, close the valve and pump air as before. The simplicity, ease of operation, and low cost of installation of this pneumatic system should commend it to any one in need of such a device.—Contributed by H. A. Carmichael, West Lorne, Ont., Canada.

A Noiseless Water Heater

A noiseless water heater that is easily and quickly made is shown in the accompanying sketch. Secure an

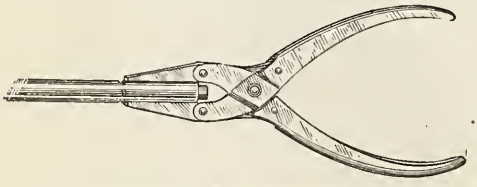


Steam Hose on the Pipe

old piece of steam hose and cut it out about 6 in. from one end as shown. Fasten the other end to the steam pipe and the heater is complete.

How to Cut Water Gauge Glasses

Where a short length of tube is to be cut off I proceed in the following manner: I mark the tube at the point to be cut with a three-cornered file, making nicks exactly opposite each other, then cut a hardwood plug and shape it to fit in the tube up to the marks. Some rubber or other soft material is placed on the tube to prevent it being crushed easily and then I grasp it



Breaking Off a Short Piece

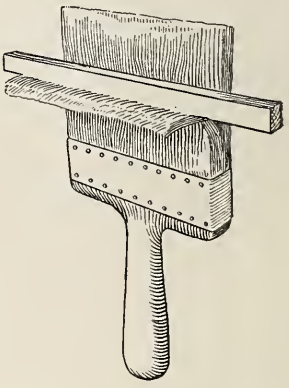
firmly with a pair of pliers as shown in the sketch. The short piece is easily broken off.—Contributed by Frank Lacina, Canby, Minn.

Color of Sparks

The color of the sparks given off by an emery wheel is a guide to the kind of metal being ground. Sometimes this is the most easy and handy way of distinguishing tool steels. Cast iron gives off dull red sparks and they stay close to the emery wheel. Wrought iron gives a spark similar to cast iron in color, but more like the spark from mild steel, which is bright yellow and flies from the wheel considerably. Self-hardening tool steel and the tungsten alloy steels make a thick shower of dull sparks, very much like the cast-iron sparks in color.

Care of Calcimine Brushes

Brushes used for calcimining will come apart if proper care is not taken to prevent them from rot, rust and drying out. If the brush is in continuous use there is danger of the bristles becoming rotten at the roots, as well as of rusting the metal binding, and if it is laid away for a time the drying and shrinking will cause it to come apart. All these troubles can be prevented if the brushes are treated in the following way: When the brush is new, or comparatively so, it should be thoroughly dried after being washed clean, then a mixture of the best spar or floor varnish and turpentine in equal parts should be poured into the binding and roots of the bristles until it has soaked through.



The manner in which this can be accomplished is shown in the accompanying sketch. Hold the brush in a vertical position with the handle down,

then part the bristles in the middle with a piece of sheet metal or a long blade of a knife. Slowly pour the mixture along the roots of the bristles until it has soaked through all around. The varnish should be warm, but not hot, to enable it to thoroughly soak in when poured into the brush. Three days at least will be required for the varnish to dry, and during this time the brush should be kept in a vertical position with the handle down. This treatment should be repeated every time there is indication of the bristles loosening, but if done thoroughly at first it is all that will be required.—Contributed by Samuel Nelson, Chicago, Ill.

Hose Fastener

A wrought-iron nail makes a very good fastener for a hose band. It can be drawn tight and will remain so, is much stronger than wire, and takes

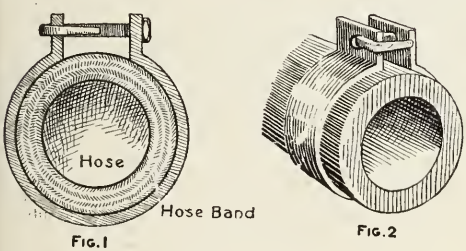


FIG. 1 FIG. 2

Clamp on Hose

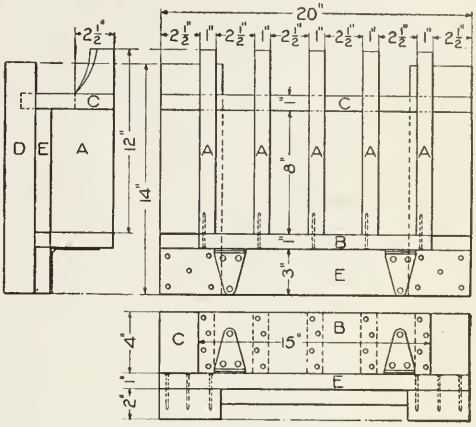
much less time and trouble to adjust than a short or rusty bolt. Figures 1 and 2 show plainly the method of attaching it to the band.—Contributed by J. M. Kane, Doylestown, Pa.

Mixing Starch with Calcimine

Select a good grade of calcimine, that to be mixed with hot water preferred. While the mixture is hot stir in 1 pt. of cooked starch such as is used in a laundry. The addition of the starch not only keeps the calcimine from drying out quickly, but it helps the mixture to cover the surface. —Contributed by Fred L. King, Islip, Long Island.

An Easily Made Concrete Brick Machine

Brick, which are a necessity upon every farm, can be easily and cheaply molded in spare moments by the use



Details of the Brick Forms

of the simple machine shown in the accompanying detail drawing.

To build, first secure five pieces of hardwood lumber, A, 1 by 4 by 12 in., and sandpaper the sides smooth. Shape a handle on one end of each and notch as shown in the end view. These five pieces are nailed to the piece B, which is 4 in. wide and 15 in. long. They should be spaced exactly 2½ in. apart, which is the thickness of an ordinary brick.

Piece C is now cut 6 in. wide and 20 in. long and notched 2½ in. deep at the top so that the division strip will set down into the notches. Two crosspieces, D, are cut 15 in. long and of 2 by 4-in. stock. Nail the piece E, which is 3 in. wide and 20 in. long, to these crosspieces as shown. The piece B is hinged to E so that the division strips, A, attached to the piece B may be raised upright and thus free the molded brick. Nine inches from the piece E fasten the piece C to the cross strips. This must be placed upright as shown in the illustration and may be fastened to the cross strips with small brackets to make it rigid. As this piece is 6 in. wide it must be cut out 1 in. at the bottom so as to set down upon the cross

strips and yet have the top level with the top of the division pieces A, so that the tops of the brick may be struck off smooth with a straight edge.

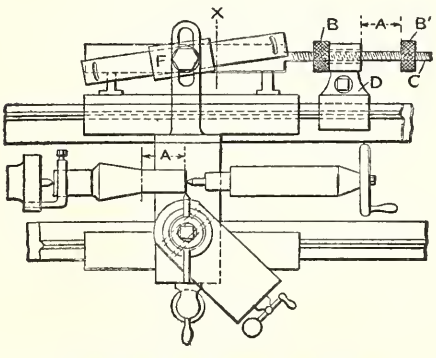
The brick are molded on a pallet which is 8 in. wide and 20 in. long. It is not fastened in any way so that it may be lifted out with the brick easily. The space for each brick is thus 2½ by 4 by 8 in., which is the standard size.

The operation is simple. Have the machine in the position illustrated, tamp the mixture into the spaces for the brick and level the top off with a straight edge. The division plates are then raised by taking hold of the part that projects beyond the board C, and lifting the whole section, leaving the brick free and on the pallet. This may then be picked up with the brick on it and set away to dry and another pallet placed in the machine, thus enabling the operator to use the same machine continuously.

All the parts of the machine should be treated to several coats of linseed oil and allowed to dry thoroughly before using, so as to render the wood more impervious to moisture and danger of warping. The concrete must not be made very wet, else it will not stand up when the mold is removed from the "green" brick. The best mixture is to use one part cement to four parts of sand or fine gravel and then wet the mixture until it is the consistency of thoroughly damp sand. Cure the brick for the first few days by covering with wet blankets. This prevents the hot sun from reaching the brick for a while, thus insuring satisfactory results.—Contributed by A. A. Houghton, Northville, Mich.

Cutting a Straight-End Taper Tap

It is sometimes amusing to see the simple manner in which some apparently hard problems are solved, says a correspondent of the American Machinist. One day the foreman received



Lathe Device for Cutting Taper Taps

a drawing of a tap which was straight for 2½ in. and then tapered for about the same distance. The taper was at least 2 in. to the foot. Turning up the tap blanks was a simple matter, but to cut the threads was quite a different proposition. Every man was busy trying to solve the problem, but it remained for a "cub" to accomplish this and he did it without any effort on his part.

The youngster was roughing out a number of small taper taps on a lathe and when they reached the man who did the finishing, he found that they were straight for a short distance on the end. It was soon discovered that the boy had not adjusted the nuts BB^1 properly and the play here was about equal to the length of the straight portion on the end of the tap. It then occurred to the foreman to try to cut the taps in a similar way. By adjusting the clamp D to the proper position and then backing up the nut B^1, a distance equal to the straight part of the tap blank it was found to work quite satisfactorily.

By looking at the sketch it will be noted that as long as the screw C is free to pass through the clamp D the work will be turned straight, but as soon as nut B^1 strikes the clamp D, the cross slide will then take the course set by the taper attachment.

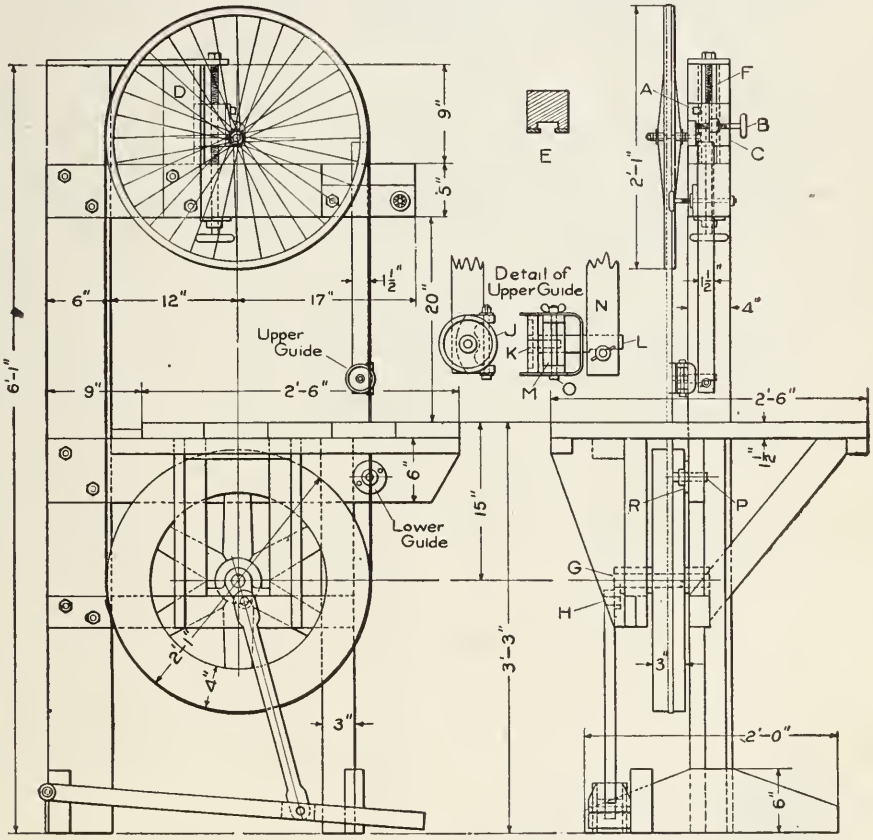
A Home-Made Band Saw

Detail drawings are here given for the construction of a foot-power band saw. This saw will prove quite serviceable in a small wood-working shop where the material to be sawed is not too heavy.

The frame is made of standard sizes of hardwood timber. The joints can be halved or mortised and they should be glued and bolted securely together. Care should be taken to get them together perfectly square, else one will have trouble in lining up the saw wheels.

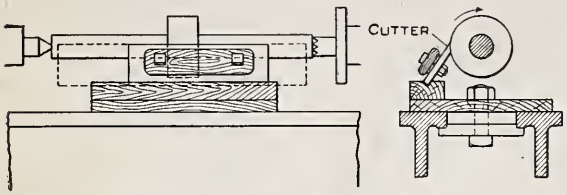
The top wheel is an ordinary front wheel of a bicycle which has the tire groove filled to a level with leather, then covered with a rubber belt. The axle is mounted on a casting which swings on the bolt A. Its angle is adjusted by means of the screw B, in the block C. This block slides in a groove in the upright piece D, a cross-section view of which is shown at E. The screw F serves as a vertical adjustment.

The bottom or drive-wheel is constructed as shown and it also should have a rubber band glued to it. It is mounted on a shaft which runs in a roller or ball bearing. A crank, G, which has a 2-in. throw, is fastened at one end of the shaft, and connects to the treadle arm. The treadle is hinged to the frame, and the pin H, which connects the arm to the crank, should be so made as to be easily removed when changing saws.



Details of the Band Saw

The upper guide consists of a revolving brass wheel, J, with a steel pin, K, fastened in it, which turns in the end of the shaft L, as shown. This shaft is fastened in the guide frame M and has one end flattened in order to be



Lathe Attachment for Grinding Tools

clamped securely in the guide post N. The V-shaped piece of band iron is slotted in the ends for the saw and it is fastened to the casting M by means of a clamp screw, O. The holes in the band are slotted to permit of adjustment.

The lower guide consists of a short length of ¾-in. diameter, cold-rolled steel bar, P, which is held in the casting R by means of a setscrew.

This machine is very simple in design and easy to construct. It can be run by power by simply attaching a pulley to the drive-wheel axle in place of the crank.—Contributed by A. H. Petri, Philadelphia, Pa.

Flat Side on a Rubber Stamp Handle

On all rubber stamps having knob handles cut a flat place on the thumb side with the bottom of the letters toward you, and the right side up can be determined instantly without looking at the face of the type. The accompanying sketch shows where the flat side is to be made on the knob.—Contributed by W. A. Humphrey, Columbus, O.

Sharpening Cutters for Wood Planers

The sharpening of cutters for woodworking machines is often a laborious task and the pattern-maker will welcome any time or labor saver in this line, says a correspondent of the American Machinist.

The sketch shows an arrangement adapted to a wood-turning lathe by which cutters can be ground uniformly hollow. For convenience in handling, the cutter is bolted to a wooden holder and a rest for the blade to slide along is constructed either as shown or it may be connected to the existing tool carrier. This is fixed at the back of the machine unless the direction of rotation can be reversed.

The grinder is a wooden collar, say 5 in. in diameter and 2 in. wide, mounted on a spindle which should be long enough to allow the cutter to slide the full length on it. After truing up, cover the surface of the collar with thin glue and sprinkle powdered emery evenly over it. The grinding is done dry at a fair speed, care being taken not to burn the blades. The finishing edge is obtained on the oilstone.

By using different shapes of grinders, with suitable rests, gouges and other tools can be sharpened rapidly. The cost of the apparatus being insignificant, will make it appeal to small shops unable to buy an expensive grinder.

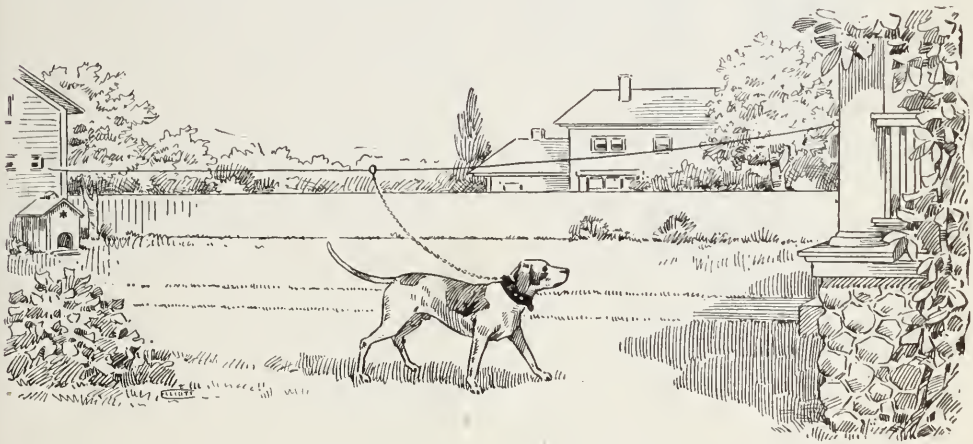
How to Mix Red Lead Paint

To mix red lead paint easily and rapidly use a revolving barrel butter churn. It is well known that red lead is a most stubborn pigment and hard to mix with hand paddles. By using a barrel churn to mix the paint an old painter will be surprised at the increased spreading qualities of the paint so mixed over that mixed with hand paddles.—Contributed by J. P. Cowing, Chicago.

AMATEUR MECHANICS

How to Chain a Dog

A good way to chain a dog and give him plenty of ground for exercise is to stretch a clothesline or a galvanized wire between the house and barn on which is placed a ring large enough to slide freely. The chain from the dog's collar is fastened to the ring. This method can be used for tethering a cow or horse, the advantage being in the use of a short tie rope eliminating the possibility of the animal becoming entangled.—Contributed by Chas. W. Thiede, Denver, Colo.

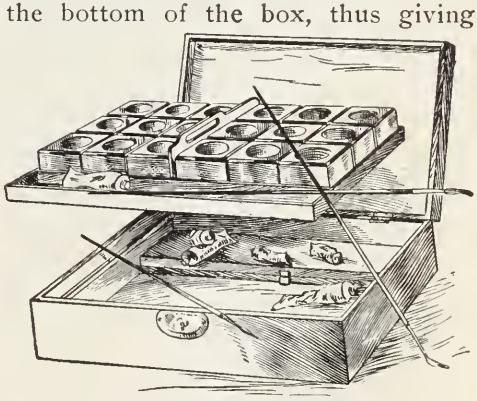


The Dog Has Plenty of Room for Exercise

Water Color Box

There are many different trays in the market for the purpose of holding water colors, but they are either too expensive for the average person or too small to be convenient. I do a great deal of water color work and always felt the need of a suitable color dish. At last I found something that filled my want and suited my pocketbook. I bought 22 individual salt dishes and made a box to hold them as shown in the illustration. This box has done good service.

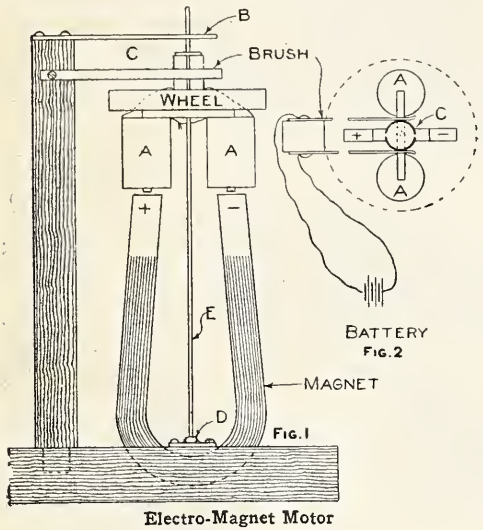
Some of the advantages are: Each color is in a separate dish which can be easily taken out and cleaned; the dishes are deep enough to prevent spilling the colors into the adjoining ones; the box can be made as big or as small as your needs require. The tray containing the color dishes and brushes rests on ¼-in. round pieces 2¼ in. from the bottom of the box, thus giving ample store room for colors, prints, slides and extra brushes.—Contributed by B. Beller, Hartford, Conn.



Color Trays Made of Salt Dishes

A Small Electric Motor

The drawing herewith shows a simple electric motor which can be easily constructed by any boy who is at all handy with tools. I made this motor



Electro-Magnet Motor

many times when a boy and can say that if carefully constructed it will run with greater rapidity than the more expensive ones.

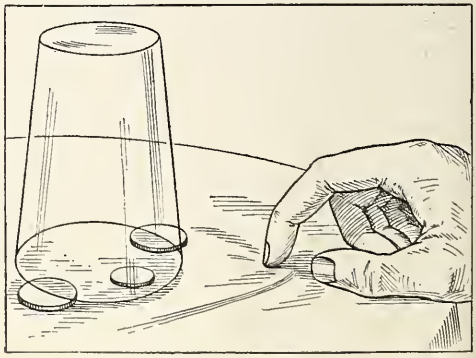
A common magnet which can be purchased at any toy store is used. The one shown is 3½ in. in length. The armature core is a strip of $\frac{1}{16}$ by ¼-in. iron, 2¼ in. long, bent U-shaped and fastened to the wood flywheel. Each leg of the armature is wound with 10 ft. of No. 24 gauge magnet wire. The commutator is made from an old 22 cartridge filed into two equal parts, each being a half circle, both of which are made fast to a collar on the shaft E. Each half of the commutator must be insulated from the other half. The collar can be made by wrapping paper around the shaft until the required size is obtained.

The top end of the shaft runs in a hole bored in a brass support, B, which is screwed on the end of a piece of wood mortised in the base, as shown in Fig. 1. The lower end of the shaft runs in a glass bead, D, which is fastened to a small piece of brass with sealing wax. The small brass piece is fastened to the base with screws. The bead should not have an eye larger in diameter than the shaft. The shaft is made from an old discarded knitting needle. The brushes are fastened to each side of the upright piece of wood supporting the brass bearing B.

The connections to the battery are shown in Fig. 2. Each half of the commutator C is connected to the coils AA as shown in Fig. 1.—Contributed by J. M. Shannon, Pasadena, Calif.

Moving a Coin Under a Glass

Place a penny or a dime on a tablecloth, towel or napkin and cover it over with a glass in such a way that the glass will rest upon two 25 or 50-cent pieces as shown in the sketch. The coin is made to come forth without touching it or sliding a stick under the edge of the glass. It is only necessary to claw the cloth near the glass with the nail of the forefinger.



Removing the Coin

The cloth will produce a movement that will slide the coin to the edge and from under the glass.

¶When playing loud and harsh records on a phonograph the music is often spoiled by the vibration of the metal horn. This may be remedied by buckling a valise or shawl strap around the horn, near the center.

Making Photo Silhouette Brass Plaques

Secure a brass plate having a smooth surface the right size for the photograph and cover it with a coat of paraffin. This is done by heating the paraffin in a vessel hot enough to make the wax run freely, then pouring the liquid over the entire surface of the brass.

When the paraffin has cooled sufficiently the outlines of the photograph must be drawn upon its surface. There are three ways of doing this: First, the photograph can be traced on tissue paper and then retraced on the paraffin surface. The exact outlines of the photograph can be obtained this way without destroying the print. Second, if you have several copies of the photograph, one can be utilized by tracing direct to the surface of the paraffin. In using either of the two methods described, carbon paper must be placed on the paraffin before the tissue paper or photograph is laid upon it. Third, cut out the outlines of the photograph and lay it on the paraffin surface, then trace around the edges with the point of a needle or sharp point of a knife. The outlines drawn by the first method are cut through the paraffin in the same way. The paraffin is carefully removed from the inside of the lines, leaving the brass surface perfectly clean, as is shown in Fig. 1.

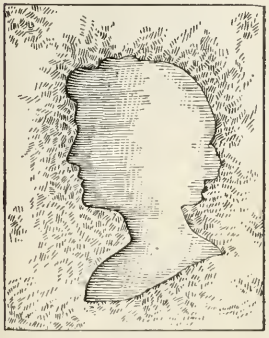


Fig. 1
Waxed Brass Plate

The exposed part of the plate is now ready to be etched or eaten away to the right depth with acid. The acid solution is made up of 1½ parts muriatic acid and 2 parts water. The mixture should be placed in a glass or earthenware vessel. If the plate is a small one a saucer will do for the acid solution. Pour the acid on the plate where the paraffin has been removed and allow it time to etch. The acid should be removed every five minutes to examine the etching. If any places show up where the paraffin has not been entirely removed they must be cleaned so the acid will eat out the metal. When the acid solution becomes weak new solution must be added until the proper depth is secured. Rinse the plate in cold water, stand in a tray and heat it sufficiently to run off all the paraffin. Polish the plate by rubbing it with a piece of flannel.

Fig. 2
Finished Plaque

The plaque can be given a real antique finish by painting the etched part with a dull black paint. Drill a small hole in each of the four corners, being careful not to dent the metal. The plaque is backed with a piece of wood ¾ in. thick, the dimensions of which should exceed those of the brass plate sufficiently to harmonize with the size of the plaque. The wood should be painted black with the same paint used in the plaque. Paint the heads of four thumb tacks black and use them in fastening the plaque to the board. The finished silhouette will appear as shown in Fig. 2.—Contributed by John A. Hellwig, Albany, N. Y.

¶Automobile headlights should be set to throw the light straight ahead, not pointed down at the road at an angle.

Wood-Working for Beginners

By IRA S. GRIFFITH

CHAPTER VI

Squaring up Mill-Planed Stock

Practically every lumber yard carries in stock lumber that has been mill-planed on two surfaces to stock thick-

Fig. 27—Trace Marks

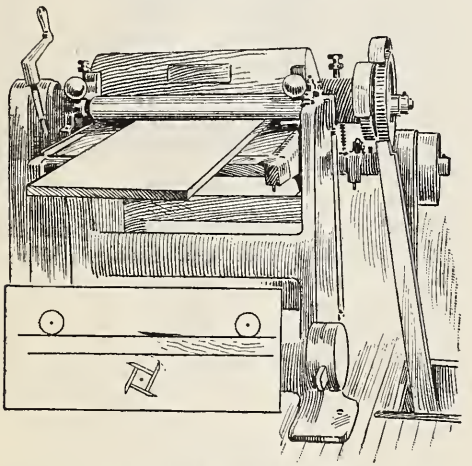


Fig. 28—Surfacing a Board

nesses. Wood-workers can specify the thickness wanted for the work they have in hand and thus avoid much of the drudgery necessitated by planing up stock entirely in the rough as it comes from the sawmill.

The first broad surface and the first edge planed have a peculiar use and definite names. The first surface is called face side or often working face. The first edge is called face edge or frequently joint edge. These are marked to distinguish them from the others, as shown in Fig. 27. They are the only ones marked. From these two faces, and these only, all testing is to be done, the beam of the try-square and the head of the gauge being held against one or the other.

In selecting these faces, the better broad surface and the better edge are taken, if the object is to consist of but one piece. If it is to consist of several parts, such as a table or a chair, the poorer surfaces are to be selected for faces. Where several parts are to be joined, the faces are turned "in" because, being the first prepared, they are more accurate than the others. Any inaccuracies in the first surfaces will appear in the others, since they are worked from the first surfaces. Some inaccuracies may be present in the second surfaces which are not present in the first set. For this reason the face sides when joined together are more likely to make close-fitting joints than the others. Frequently there is little choice of surfaces. Generally, however, slight streaks of sapwood, smoothness of surface, etc., will be the determining factors.

Planing First Surface

Should the piece not be of equal width and thickness, select the broad surface which is desired for face side.

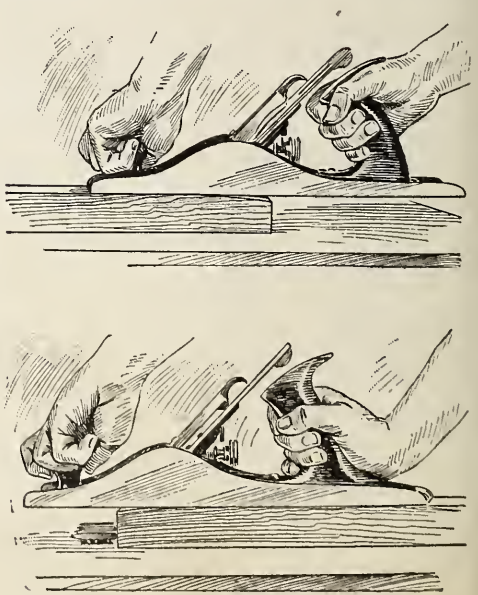


Fig. 29—Starting the Plane and Finishing the Stroke

With the smooth plane remove the mill-marks from it. Mill-marks are the little ridges and hollows which extend across every piece of mill-planed lumber. In mill-planing, a series of knives, two and sometimes four, are caused to revolve very rapidly above or below the board, sometimes both above and below, as it passes through the planer, shown in Fig. 28. If the knives are properly set, revolve very rapidly, and the board is not made to travel over the planer bed too rapidly, these marks are hardly noticeable. They must be removed with the hand plane, however, from any lumber that is to be used for interior finish or cabinet work. If they are not removed, the filler or stain will tend to "bring out" and emphasize every hollow and thus give the wood an ugly, streaked appearance.

Since it is difficult to tell where the smooth plane has or has not cut in removing these marks, it is a good plan to make a series of light pencil lines across the board at frequent space intervals before beginning to plane.

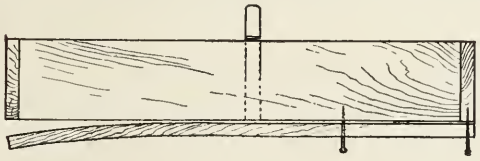


Fig. 31—Nailing Out "Dished" Board

When these have been removed the mill-marks will have been removed, too.

In planing, press firmly on the knob in starting and upon the handle in stopping the stroke, or the ends of the board will be lowered too much, as shown in Fig. 29. If the board is a long one, it will be necessary to start and stop some of the strokes in its middle. That no marks may show where this takes place, the shavings must be "feathered." This is done by lowering the toe of the plane first in starting and by raising the heel of the plane gradually as the completion of the stroke is neared. This is shown in Fig. 30.

A board will very often become warped or dished after having been

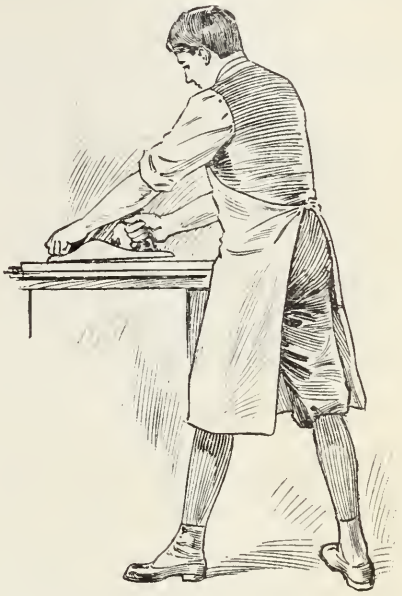


Fig. 30—Lifting Plane on the Return Stroke

planed level at the mill. The nature of the work in which it is to be used will determine whether or not this first surface is to be leveled or merely smoothed. If dished much, and the work requires a level surface, a new piece or a thicker piece will be needed. In many cases the dish will "nail out" so that the first surface needs only smoothing. This is illustrated in Fig. 31, where a bottom board is being nailed to the side of a box. When this

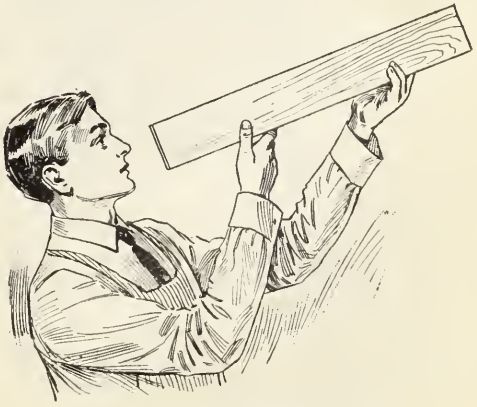


Fig. 32—Sighting Lengthwise

surface has been sufficiently smoothed, mark it for a face side.

Planing First Edge

Select and prepare one of the edges for a face edge. Place the piece against

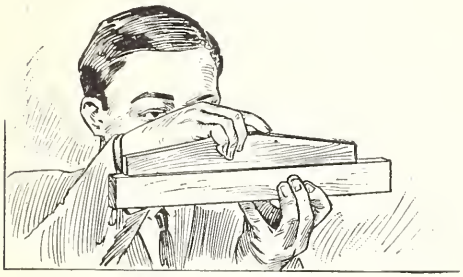


Fig. 33—Using a Wood Straightedge

the bench stop or in the vise. The jointer is usually used for edge planing after the jack-plane has been used to remove the roughness. After a few strokes, hold the board toward the light, close one eye and look along the edge, Fig. 32, to see whether it is straight or not. Practice will soon enable one to know when the edge is straight. At first it may be well to use a straightedge test in addition to the sight test. This is done by placing something having a straight edge as shown in Fig. 33, holding the board and straightedge between the eye and

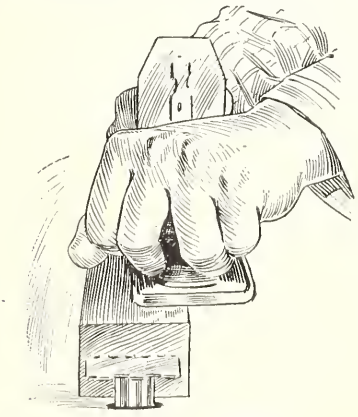


Fig. 35—End View of Plane

the light so that any unevenness may show plainly.

The second test is to place the try-square as in Fig. 34. Hold the beam firmly against the face side and make the test at a sufficient number of places along the edge to show its true condition. Should light show under the blade, note where it is, place the piece in the vise again and move the plane over to the side opposite that at which the light appeared, Fig. 35. Take off no more shavings in planing this edge than are absolutely necessary to get it straight and square. The final stroke should be taken the full length of the board and the shaving should be very

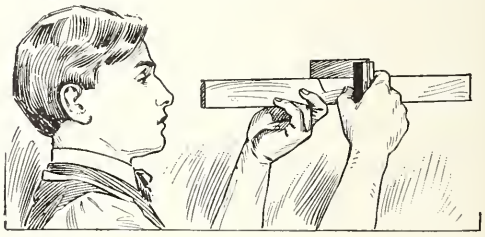


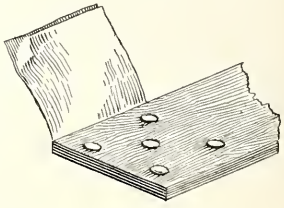
Fig. 34—Try-Square on First Edge

thin. Mark this edge as in Fig. 27. It is to be known as the face edge.

(To be Continued.)

Sad Iron Polisher

A small amount of wax is necessary on an iron for successful work. The wax is usually applied by hand to the heated surface of the iron. A much better and handier way is to bore five or six holes in one end of the ironing board to a depth of half its thickness, filling them with wax, beeswax or paraffin, and covering them over with two thicknesses of muslin. The rubbing of the hot iron over this cloth absorbs just enough of the wax to make the iron work smoothly. When the supply of wax is exhausted it can be easily renewed.—Contributed by A. A. Houghton, Northville, Mich.



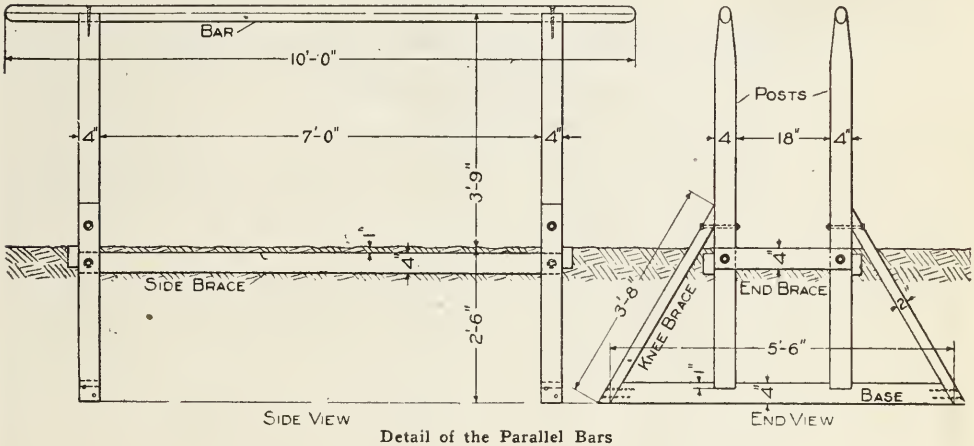
An Outdoor Gymnasium

Part II—Parallel Bars

Parallel bars hold a high place in the affection of those who frequent gymnasiums as the best apparatus for development of the back and shoulder muscles, as well as a promoter of ease and grace of movement. The outdoor "gym" can have a set of these bars with very little more labor than was required for the horizontal bar.

The material required is as follows: 4 posts, preferably cedar, 4 in. square and 6 ft. long; 2 base pieces, 4 in. square and 5½ ft. long; 2 cross braces, 2 by 4 in. by 2 ft. 2 in. long; 2 side braces, 2 by 4 in. by 7 ft. 8 in. long; 4 knee braces, 2 by 4 in. by 3 ft. 8 in. long; 2 bars of straight grained hickory, 2 by 3 in. by 10 ft. long; 4 wood screws, 6 in. long; 4 bolts, 8 in. long; 8 bolts, 7 in. long and 1 doz. large spikes.

To make the apparatus, lay off the bases as shown in the end view and bevel the ends at an angle of 60 deg. Chisel out two notches 4 in. wide and 1 in. deep, beginning at a point 9 in. from either side of the center. These are to receive the lower ends of the posts. Bevel two sides of one end of each post down to the width of the finished bar—a little less than 2 in. Cut notches in these ends to receive the oval bars. Bevel the ends of the knee braces, as shown in the diagram, and fasten the lower ends to the beveled ends of the bases with the spikes. Fasten the upper ends of the knee braces to the uprights with the 8-in. bolts put through the holes bored for that purpose, and countersinking the heads. Lay the whole end flat on the ground and make a mark 2½ ft. from the bottom of the base up along the posts, and fasten the end braces with their top edges flush with the marks, using four of the 7-in. bolts. Finally toe-nail the base into the ends of the posts merely to hold them in position while the whole structure is being handled.



Detail of the Parallel Bars

Two endpieces must be made. These sets or ends of the apparatus are to be buried in trenches dug to the depth of 2½ ft., with the distance between the two inner surfaces of the posts, which face each other, of 7 ft. After the trenches are dug, additional long, shallow trenches must be made connecting the posts to receive the side braces. The function of these side braces is to hold both ends together solidly. It is necessary to bury these braces so they will be out of the way of the performer. The side braces are bolted to the posts just below the cross braces, so the bolts in both will not meet. The bars

are dressed down so that a cross section is oval as shown in the end view. They are to be screwed to the notched ends of the uprights with the 6-in. screws. The holes should be countersunk so they can be filled with putty after the screws are in place. The bars should be well oiled with linseed oil to protect them from the weather, and in the winter they should be removed and stored.

Every piece of wood in this apparatus can be round and cut from trees, except the bars. If using mill-cut lumber, leave it undressed, and if using round timber leave the bark upon it as a protection from the weather. It is well to paint the entire apparatus, save the bars, before burying the lower part of the end pieces. The wood so treated will last for years, but even unpainted they are very durable. Be sure to tamp down the earth well about the posts. A smooth piece of ground should be selected on which to erect the apparatus.

(*To be Continued.*)

How to Make a Wireless Telegraph Set

Part III—The Condenser

By Arthur Moore

Spark Coil Construction—Part II

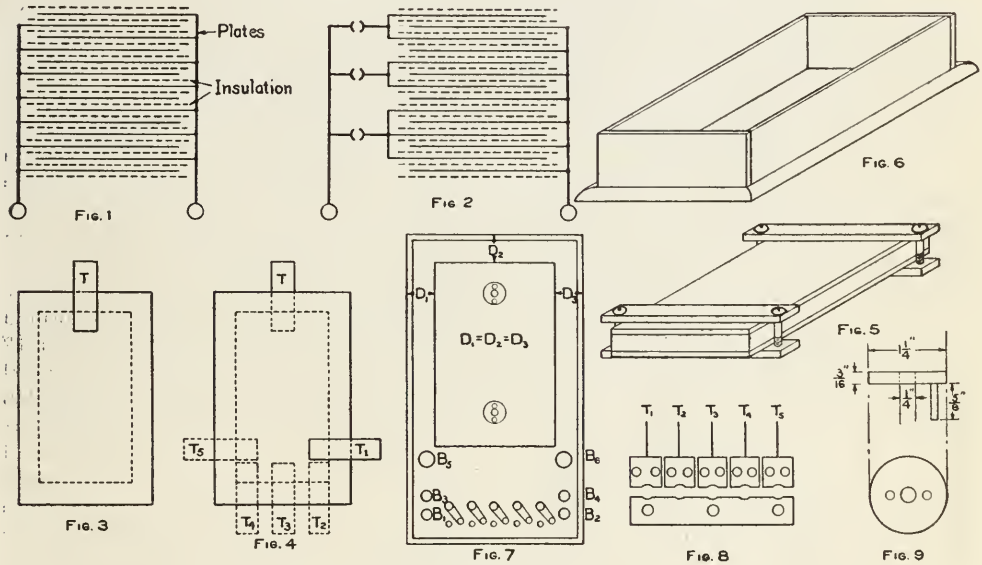
After your coil proper is completed you can proceed with the construction of some of the other parts while you are waiting for the various coats of varnish to dry on the containing case. It would be well to construct the condenser next as it will require some time to dry thoroughly, and your coil will be ready to assemble when the remaining parts are complete. The purpose of the condenser is to reduce the spark at the contact in the interrupter, which increases the life of the contact and at the same time causes a more rapid change of current in the primary, thus increasing the voltage induced in the secondary. A condenser consists of two electrical conductors separated by an insulating material called the dialectric. The capacity of a condenser depends upon the area of the conductors, their distance apart, and the kind of material or dialectric separating the plates. You will need at least 2,400 sq. in. of exposed plate in a condenser suitable for the coil you are constructing. Now instead of attempting to build the condenser by using only two sheets, you can reduce its size by increasing the number of plates and arranging them as shown in Fig. 1. In determining the size of plates to use in the condenser you should bear in mind the fact that it would be desirable to mount the condenser in the sub-base of your coil. The upper containing case was 10¼ in. long, and approximately 6 in. wide, outside dimensions. This case should be mounted upon a second case about 11 in. wide, and 17 in. long. If it is made of ¾-in. material that will give inside dimensions of 9½ by 15½ in. You will want to allow at least ½-in. clearance at both sides and one end, and about 3 in. at the other end where connections can be made to the condenser. This will give you the dimensions of your insulating sheets 8½ in. wide and 12 in. long. The tinfoil that you will use as the conductors should be cut into sheets 6 by 8 in. Each of these sheets will have an area of 48 sq. in. and since there is a total of 2,400 sq. in. required you will need 50 sheets. Twenty-four of these sheets will be connected to one terminal and the remaining 25 to the other. You may think that there will be 50 positive and 50 negative plates required, but each plate will have both surfaces exposed as shown in Fig. 1, and only half as much tinfoil will be required in a condenser of this type as in one consisting of only two large sheets.

Procure a small quantity of the very best grade of thin bond paper and cut

about 60 sheets 8½ in. wide, and 13 in. long. These sheets of paper should be boiled in paraffin for about one hour and hung up to drain. The paraffin should be real hot when the sheets are removed so that it will drain off easily, resulting in a uniform thickness throughout. When they have cooled, cut ½ in. from each end, making the sheets 8 in. wide by 12 in. long. Now cut from some tinfoil 50 pieces 1 in. wide and 4 in. long, that are to be used in making connections to the various sheets or plates of the condenser.

connections of these switches will be taken up in a future chapter.

To build up your condenser, you should proceed as follows: Lay a sheet of the paraffin paper on a smooth board and place a sheet of the tinfoil in the center of this piece of paper. Take one of the small tinfoil connecting strips and put it in place as shown in Fig. 3. Now place a second sheet of paper in place and run a squeegee print roller over it, applying quite a little pressure, thus removing any air that might exist between the foil and paper.



Details of a Condenser

It is impossible to predetermine the exact capacity that will give the best results, and for this reason it would be best to divide your condenser into a number of parts so that the capacity can be varied. Such an arrangement is shown in Fig. 2, which amounts to connecting a number of condensers in parallel. To construct your condenser so that it will correspond to the above arrangement you should divide the connections to one set of plates into, say, five groups, and these various groups can be connected to switches on the top of the lower base of your coil. The construction and

Place a second sheet of tinfoil in place and make the connection to it as shown by full line in Fig. 4. Continue in this way until you have a total of 10 sheets in place. The odd numbered sheets being connected together at the point T and the even numbered sheets connected together at the point T_1, Fig. 4. The odd numbers of all the remaining sheets should be connected to the common terminal T, and the even numbers should be grouped, five sheets to the group, and connected to the terminals T_2, T_3, T_4, and T_5. The terminals should be arranged as shown in Fig. 4, so that there is no likelihood of

them coming in contact with each other. After all the plates are in place, lay three or four sheets of paper on the outside of the condenser and clamp it between two boards as shown in Fig. 5. The terminals formed of the tinfoil connecting strips are very weak and can be easily broken off when handling, so that they should be strengthened by folding some pieces of very thin brass over them, the end of the brass strips being slipped between the plates when the condenser is under construction.

You should now heat the condenser until the paraffin softens, at the same time increase the tension in the screws, and then allow it to cool. It might be well to boil the condenser in paraffin as that will remove any air that may have collected between the plates.

You are now ready to construct the containing case for the condenser. This case should be about 1 in. deeper, inside dimension, than the depth of the condenser. The ends and sides of this box can be fastened together in the same way you made the coil case, and should be made of ¾-in. material. The bottom should be of such a size that it will project ¾ to 1 in. beyond the sides and ends of the case. Round off the corners as shown in Fig. 6 and fasten it to the frame with screws from the under side. The top of this case should be made of ⅝-in. material with the edges rounded and fastened to the frame with brass screws. Fasten this piece to the base of the upper case with screws, countersinking their heads. The position of the upper case on its base is shown in Fig. 7. After the holes have all been drilled for mounting the upper case the lower case should be nicely finished to match the upper one.

Mount the condenser in the end of the lower case, Fig. 7. Small blocks of wood can be fastened to the side of the case and the clamps on the condenser fastened to them, thus holding it rigidly in place. The end of the condenser with all the terminals on should be toward the open end of the box. Mount upon the end of the top of the lower case five small switches as shown in Fig. 7. One point on all of these switches should be connected to one line which is to form one terminal of the condenser. The other points of the switches should be connected to the terminals T_1, T_2, T_3, T_4, and T_5 of the condenser. Mount two back-connected binding-posts B_1 and B_2, Fig. 7, and connect the terminal T of the condenser to one of them and the common connection of the switches to the other. You can now vary the capacity between B_1 and B_2 by manipulating the switches S_1, S_2, etc. By placing these binding-posts on the base and connecting your condenser to them you can use the condenser for other purposes than across the contacts of the vibrator. Two other binding-posts, B_3 and B_4, should be mounted beside B_1 and B_2 and they should be connected to the two sides of the vibrator contact. Connecting B_1 and B_3 together and B_2 and B_4 together with a piece of wire you will have the condenser across the contact. Mount two more binding-posts, B_5 and B_6, a little larger than the others as shown in Fig. 7. These are to form the terminals of the primary winding.

A single switching device for the condenser is shown in Fig. 8. The various pieces of brass can be cut from some ⅛-in. sheet brass and fastened to the board with round-headed screws. After they are all in place a tapered reamer can be used in cutting the openings between them. The connections can now be made by inserting small tapered plugs in these openings.

You can get a better variation in your capacity by using the following combination instead of the one given in the first part of the article: First section, 14 sheets; second section, 12 sheets; third section, 10 sheets; fourth section, 8 sheets and the fifth section, 6 sheets. This gives the same total capacity as in the previous case, as the same total number of plates is used.

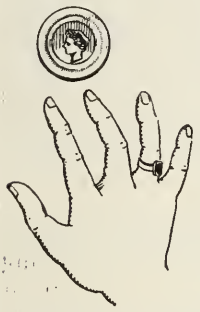
Cut from some ⅛ or $\frac{3}{16}$-in. brass two pieces whose dimensions corre-

spond to those of Fig. 9, that are to form part of the terminals of the secondary winding. These two pieces should have ¼-in. holes drilled in their centers and tapped. Countersink them in two openings cut in the top of the upper case about 8 in. apart and fasten them in place with two flat-headed brass screws. A piece of ⅛-in. brass about ¾ in. long should be soldered to the under side as shown in Fig. 9. These pieces will project through the under side of the case top and the terminals of the secondary winding can be soldered to them, leaving quite a little slack in the leads. It might be best to make the leads from the coil to these plates of wire insulated to stand a high voltage.

(To be continued)

Making Coins Stick to Wood by Vacuum

Take a quarter and place it flat against a vertical surface of wood such as the side of a bookcase, door facing or door panel, and strike it hard with a downward sliding motion, pressing it against the wood. Take the hand away and the coin will remain on the woodwork. The striking and pressure expel the air between the quarter and the wood, thus forming a vacuum sufficient to hold the coin.



How to Make a Table Mat of Leather

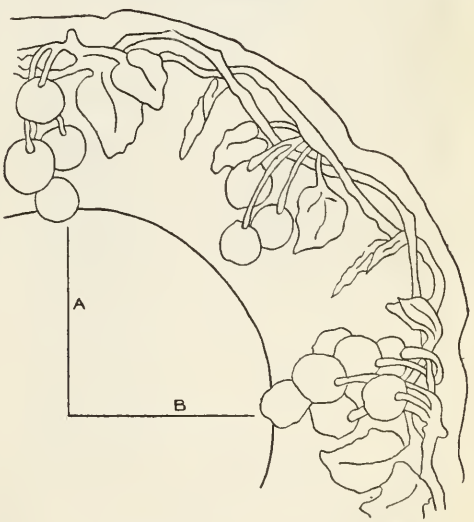
The table mat, the design of which is shown herewith, is to be made of leather. It may be made of Russian calf and the background modeled down as has been described in several previous articles dealing with leather work. To do this the leather is moistened on the back side just enough to make the leather take the impression of the tool, but not enough to make the moisture show through on the face. Any smooth piece of steel, such as a nut pick, that will not cut or scratch the leather and will make a V-shaped depression will do.

A second method is to secure a piece of sheepskin and, using the reverse side, outline the design by means of a pyrographer's outfit. This manner of treating leather is so common that it needs no description.

A third method is to secure a piece of sheep or goat skin, trace the design on the reverse side by means of carbon paper, and put the outline and design in with brush and stains such as are sold for this purpose.

The accompanying pattern shows but one-fourth of the mat. Draw the one-fourth on paper to the size desired and then fold on lines A and B, tracing this one-fourth on the other parts by the insertion of double-surfaced carbon paper.

On the calfskin the pattern is to be held on the leather and the tool worked



Pattern for the Table Mat

over the pattern to get the outline transferred. After this the pattern is to be removed and the leather modeled.

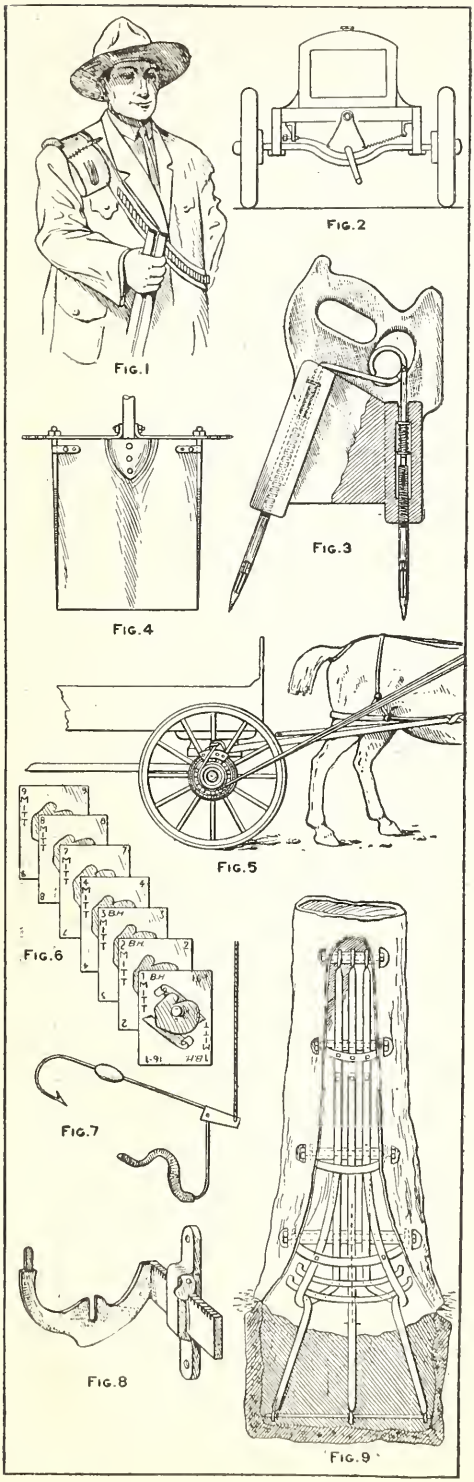


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

INTERESTING PATENTS,

COMBINED CARTRIDGE-BANDOLEER, GUN-REST, AND RECOIL-PAD—This army device (Fig. 1) provides for the carrying of cartridges, as does any bandoleer, and in addition is provided with a recoil-pad for service in firing, and a gun-rest for use in carrying. The gun-rest and recoil-pad are constructed to be detachably connected to either side of the shoulder strap, so that they can be used when the bandoleer is strung over either shoulder.

SAFETY AUTO-CRANK DEVICE—Figure 2 shows a device for automatically securing the starting handle of an automobile in an effective and positive manner. It consists of a device operated or controlled from the speed lever to render the engagement of the starting handle with the engine shaft impossible except when the speed lever is in a neutral or inoperative position. The device is placed in position in front or around the extremity of the engine shaft, connected with the speed lever so that the slot provided in it for the admission of the starting handle assumes a position in alignment with the shaft when the lever is in the position above stated.

HAND-SHOCKING DEVICE—A hand device for shocking grain is illustrated in Fig. 3. It consists of a body portion provided at one end with a hand-hold, pointed tines projecting from the body portion, pivoted fingers carried by the tines, and means operated by the hand-hold for causing the fingers to be projected laterally from the tines in rear of the pointed ends. In the tines are movable rods ending in a ring which sets in a hollow in the hand-hold. In clutching the shocker, one or more fingers engage with this ring and operate the mechanism by pulling it outward, while sets of springs accomplish the opposite movement.

SOD-CUTTING ATTACHMENT FOR SPADES—Figure 4 is a sod-cutting attachment and foot-rest for spades. The manner of attaching it to the spade is shown.

SAFETY LINE-HITCH FOR WAGONS—The moment a horse starts, if this device (Fig. 5) is in operation, the reins wind up and the animal is forcibly brought to a stop. It consists of a cap or band provided with inwardly and outwardly projecting flanges. The reins are passed around the band and made fast to one of the wheel spokes by a double-hook, rein-holding device.

BASEBALL CARD GAME—This drawing (Fig. 6) shows seven cards of one suit of the series of suits into which the cards of a baseball card game are divided. The respective suits bear representations of a catcher's mitt, a baseball diamond, a bat, and a ball. Each suit consists of cards bearing designations indicating a one-base hit, a two-base hit, three-base hit, home run, a fly ball, a catcher, an umpire, a "fan," and a pitcher.

FISH-HOOK THAT SPEARS THE FISH—A fish-hook that catches the fish eating the bait in the body as well as in the mouth is here illustrated (Fig. 7). It consists of a bait hook, a gaff hook hinged to the bait hook, and a buoyant body carried by the gaff hook. The fish makes a dash for the bait, and in doing so pulls the gaff hook downward into its body.

EXTENSION HOOK FOR WINDOW CURTAINS AND SHADES—An extension curtain fixture which will support both lace curtains and shade-roller is illustrated in Fig. 8. The method of extension as well as the means for supporting the shade-roller and curtain pole are clearly shown in the drawing.

PROCESS OF REINFORCING TREES—This patent (Fig. 9) has to do with a method of reinforcing a tree having a cavity in its trunk. It consists of a process of placing the reinforcement in the cavity, securely attaching it to the trunk, and anchoring it to the earth.

PRACTICAL OR UNIQUE

ACETYLENE GAS POP-GUN—This gas pop-gun (Fig. 10) is essentially a gas engine with a cork instead of a piston. Gas is generated in the gun, mixes with the air, and the mixture is exploded by an electric spark exactly as in the gas or gasoline engine. In the gasoline engine, the mixture of air and gasoline vapor is strongly compressed before explosion in order to get sufficient energy to work the piston. In this cannon the acetylene gas is exploded without being compressed and the only effect of the explosion is to propel a light cork and produce a loud noise. Using acetylene, the total amount of inflammable material at each shot is said to be only equivalent to about a quarter of a drop of alcohol or gasoline, and the carbide in the bottle is not inflammable at all, as it must be put into the water before acetylene is produced.

ELECTRIC ICE-SEVERING DEVICE—Figure 11 is a device for severing ice by electrically generated heat. It consists of an angular severing blade of high resistance, and a flexible connection leading to electric supply.

COMB ATTACHMENT FOR HAIR-TINTING—This brush attachment for an ordinary comb (Fig. 12) is designed as a means of evenly tinting the hair. It is provided with spring clips to attach it to the comb. Between the bristles is an absorbent material for the dye.

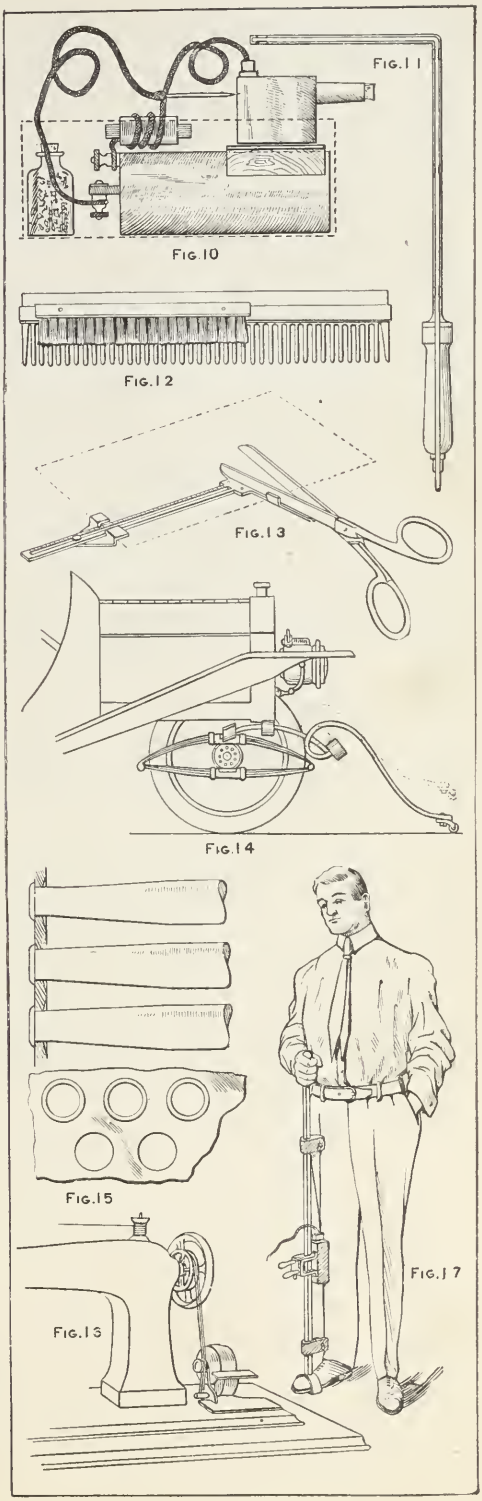
GAGE ATTACHMENT FOR SHEARS—A pair of shears provided with a measuring device is shown in Fig. 13. Its method of adjustment and operation is explained by the drawing. It was designed for cutters of cloth goods.

LIGHTWEIGHT AUTO FENDER—The objection to nearly all fenders proposed for automobiles is due to the awkward and bulky nature of the devices, but this fender (Fig. 14) is, if anything, too far toward the other extreme. The body of the fender consists of two parallel spring slats attached to two spring hangers. The forward ends of the fender are provided with rollers, which engage with the road when the fender is brought into action by striking a person. At other times the fender ends ride a few inches above the roadbed.

SYSTEM OF FLUE-SETTING—A new system of boiler-tube setting, which prevents the erosion and leaking caused by the intense heat in the combustion chamber and on the tube sheets, is shown in Fig. 15. This is accomplished by reducing the section of thickness of metal interposed between the water and the fire. It also consists of swedging or reducing in diameter the ends of the tubes, and by so doing doubles the capacity for water at that point and induces free circulation about the tubes, limiting the expansion caused by the temperature. The reducing of the tube ends at the combustion chamber limits the rapid flow of hot gases through them, but still maintains the heating surfaces by the expansion of the gases as they pass from smaller to larger diameter of the tubes, which means the reduction of stack temperature and cost of fuel.

SCISSORS-SHARPENER—A scissors-sharpening attachment for sewing machines is illustrated in Fig. 16. It is a small grinding wheel mounted in such position on the sewing-machine stand as to be operated by engagement with the belt which drives the sewing machine. Extra belt attachment is in this manner made unnecessary.

PANT-PRESSING DEVICE—This very unique trouser-pressing and creasing apparatus (Fig. 17) is electrically heated. It consists of a support provided with means to engage with the leg of the pant and hold it in the form of a fold, and an electrically-heated creasing and pressing machine, which engages with the trouser fold and is moved up and down the support.



THE smart young man—his school honors thick upon him, and his intention to teach the world in general and his father in particular the manner in which up-to-date commerce should be conducted—stood earnestly holding forth in his father's office.

"You may rely upon me, sir," he was saying, with fervid emphasis. "I will devote my whole life to the interests of the business. It shall be my aim and ambition to keep the family name free from stain."

"Good!" said the old man gruffly. "That's the spirit. Tell the office boy to give you the whiting and ammonia; then go and polish up the brass name plate on the door."—London Mail.

◆ ◆ ◆

Coast Guard—Yes, they raise all their own vegetables on that lighthouse.

Tripper—Dear me! How do they manage to do that?

Coast Guard—With a rope!—Comic Cuts.

◆ ◆ ◆

Prof. Percival Lowell, the eminent Martian astronomer, said in a recent interview in New York:

"The Martian canals are not Panama canals. The word 'canals' you know, really means 'lines.' It shouldn't be taken literally, as the servant girl in Boston took the parlor magic.

"An amateur magician in a Beacon street house was going through his tricks while a maid passed in and out with refreshments.

"The magician was reading letters placed under a rug as the maid brought in a tray of lemon ices.

"'What letter is this?' a spectator asked.

"'That is B,' the magician answered, and, sure enough, his answer was correct.

"The maid looked with astonishment at the letter which had been hidden under the trick rug. She turned her gaze on the handsome young magician who had read it. Then, setting down her tray of ices, she hid her rosy face in her hands and ran out of the room.

"'What's the good o' me clothes?' she cried."

◆ ◆ ◆

"We keep our own cow," explained the hostess, proudly. "So we're sure of our milk."

"Well," interrupted the small son of the guest, setting down his cup, "somebody's stung you with a sour cow."—Cleveland Leader.

◆ ◆ ◆

It was the tiniest of tiny flats.

"Yes, sir," said the maid, "the stork arrived with a fine baby boy."

"Great Josephus!" exclaimed Mr. Flatte, who had been away on a trip. "That means more room. Have you hung the broom in the air shaft?"

"Yes, sir."

"And trimmed the leaves of the rubber plant down to one-half their normal size?"

"Yes, sir."

"Then take the pet dog to the fancier's and have his tail cut off. We must economize room in some way. Thank goodness it wasn't twins."—Chicago News.

◆ ◆ ◆

"What's the matter, dear?" queried Mrs. Owl, as the other half of the family appeared at their hollow tree apartments minus half his feathers. "Been fighting?"

"Not any," growled Mr. Owl in reply. "I got tangled up in a wireless message."—Chicago News.

◆ ◆ ◆

Bob was telling about his visit to the country. While there he had acquired some rustic idioms, and his mother was correcting these as he proceeded.

"Well, we goes up—"

"Went up."

"Went up on the farm—"

"To the farm."

"To the farm, and there we see—"

"We saw."

"We saw a little kid—"

"Little child. Now begin again and tell it properly."

"Well, we went up to the farm, and there we saw a goat's little child."

(Further narration suspended.)

"Brown is the laziest man on record."

"How so?"

"When his wife asks him to water the flower bed in the back garden he throws a bucket of water on his Newfoundland dog and then makes him stand in the middle of the flower bed and shake himself."

◆ ◆ ◆

Orville Wright, at a banquet in Dayton, told of an obstinate old Daytonian who, looking up one still afternoon at the Wright biplanes circling smoothly and steadily through the air, said:

"When people first told me about this here flyin', I called 'em liars. Then, when I read about it in the papers, I said it was a fake."

The old man watched the biplanes moving in great curves like lazy birds, shook his head thoughtfully.

"By crinus!" he said, "I ain't what ye mout call convinced yet, nuther."

◆ ◆ ◆

"What's the trouble?" asked the clerk. "Isn't your room satisfactory?"

"Yes," answered the guest at the big skyscraper hotel, "but I want those clouds pushed away from my windows."—Hotel World.

◆ ◆ ◆

"See that measuring worm crawling up my skirt?" cried Mrs. Bjenks. "That's a sign I'm going to have a new dress."

"Well, let him make it for you," growled Mr. Bjenks. "And while he's about it, have him send a hookworm to do you up the back. I'm tired of the job!"

◆ ◆ ◆

The telephone girl had married well, and was stopping at a hotel with her husband. Rising at 10 a. m., she rang the bell for the servant.

"Why didn't you wake me up, as I instructed you?" she asked.

"I did, ma'am," answered the slavey, "but when I said, 'Seven-thirty,' you replied, 'Line busy. Will call you up.'"—Lippincott's.

◆ ◆ ◆

Old Lady—Well, my boy, and what do you want?

Boy—I've called for the reward of five shillin's wot you offered for the return of your canary.

Old Lady—But that is a cat you have there!

Boy—Yes, I know, mum; but the canary's inside of 'im. I just seen 'im eat it."—The Tatler.

◆ ◆ ◆

"John! John!"

"Huh-wha-what is it?"

"There's a burglar in the house!"

"All right, I'll get out and look for him."

"John—John! Oh, where are you?"

"Whatye want?"

"I hear the burglar under the bed."

"Hush! that ain't the burglar, that's me."—Houston Post.

◆ ◆ ◆

"What are you doing with those field glasses?" asked the mother.

"Oh," said the daughter, as she turned her gaze skyward again, "I am looking for Jack; he said he would be down this evening."—Life.

◆ ◆ ◆

"Pardon me, madam, but the way that man across the aisle is staring at you must be very offensive. Do you wish me to interfere?"

"Oh, no, thank you. That's my husband."

"Your husband!"

"Yes. He's very nearsighted and thinks I'm somebody else."

◆ ◆ ◆

Professor—Jones, will you differentiate between the words "discover" and "invent?"

Jones—Well—er—Peary discovered the pole and Cook invented it.—Dartmouth Jack-o-Lantern.

◆ ◆ ◆

Warden—No'm the guy that killed his family ain't here no more. The Gov'nor pardoned him.

The Visitor—What a shame! I've brought him a lot of roses! What other murderers have you?

—Cleveland Leader.

POPULAR MECHANICS

H. H. WINDSOR, EDITOR, 225 Washington St., CHICAGO, U. S. A.

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Contents for October, 1910

Paddling Life Preserver....457
"Live" Miniature Battleships....458
The Telescopes of the Alps....459
Glass Made from Slag....459
The Coming Leviathians....460
Proposed Pack for U. S. Infantry....460
Revolving Cafe for California Resort....462
Internal Combustion Utilized in Ancient Times.462
Sliding on Cables High in the Air....463
China's First Really Chinese Railroad....465
New Type of U. S. Navy Target Rafts....471
Combined Cigar-Lighter and Game of Chance..472
Steam Turbine-Electric Locomotive....472
U. S. Army Searchlight Auto....473
"Give and Take" Mail Catching Apparatus....474
Phonograph Teaches Singing in School....474
An Artful Interior-Decoration Illusion....474
Tetanus Spread by Automobiles....475
Nest on Top of Street Lamp....475
Foreign Bodies Lodging in the Heart....475
The Vibration of Big Guns....477
University Has Graduate Course in House Decoration....477
Iron Serving Man....477
How a Southern Mill Owner Creates Efficiency and Contentment in His Employes....478
The Advertising of Aerial Craft....480
The Woman and the Car....482
Copy-Holder Provided with Line Indicator....482
Growth of the World's Shipping....482
Across the Atlantic in an Aeroplane....483
Paris Preparing for Future Floods....490
Blind Persons to Use Whistles....490
The New Pilgrim Monument....491
Water Transportation Between Chicago and the Mississippi....492
Greatest Railroad Terminal in World....493
Remains of a Japanese Sent Home by Mail....495
American Yacht Wins in English Races....497
Cornea Grafted on Eye Restores Sight....497
Belgian Exposition Fire Scenes....498
Mining in the Philippines....500
Finding Pearls with X-Rays....500
An Aeroplane Built to Carry Eight Passengers..501
The Guiding Lights of the Oceans....501
Devastation of Forests by Fire....503
Hand-Painted Hats Latest Millinery Fad....503
Mechanical Cut-Off for Parliamentary Bores....504
The French Submersible Accident....504
Events of the Month in Aeronautics....505
An American Woman Motors Around the World.506
Ten Billion Postage Stamps Required This Year.506
New Rifle Discharges 500 Bullets per Minute....507
Unveiling a Statue by Electricity....507
Bicyclist Performs Feats at Aviation Meet....508
Auto Trip from Coast to Coast in Ten Days....508
Chess on Shipboard by Wireless....508
What Becomes of the Old Automobiles....509
Disinfecting Seattle with Salt Water....512
"Sweating" Gold Coins....512
Jenatzy Breaks Oldfield's Speed Record....512
First Gas-Engine Liner to Be Built....513
A Proposed Method of Raising the "Maine"....514
Editorial by H. H. Windsor....515
How Chicago Handled the Knights Templar Parade....517
Definitions of Engineering....520
New Means of Escape from Sunken Submarine..521
Minnesota's Industrial Prosperity....522
To Test Effect of Forest on Stream Flow....522
Wonderful Buddhist Cave Temple....523
Unique Photograph of Bear Cubs....523
Automatic Hose Brackets....524
Bathtub for Elephants....524
Plan to Remodel British Royal Residence....525
The World's Output of Metals....525
Master Clock a Masterpiece....525
Special Auto for Training Beginners....526
Device Allows Street Cars to Run Over Hose..526
Telewriter Attached to Telephones....527
The Oil Nuisance in Harbors....527
Artistic Arrowhead Made in Railroad Shop....528
Motor-Bus Has Unique Power Plant....528
New Chinese Coinage....528
Training the Steamship Captain of Tomorrow..529
A Unique Hitching-Post....531
Walking Stick with Electric Light....532
Searchlight Ports to Protect Battleships....532
The Navy Experimenting with the Gyroscope..532
A Millionaire's Game Building....533
Water-Tube Boilers of Japanese Cruiser....534
United States Explosive Most Powerful in World.534
The Ten-Million-Dollar Irrigation Project in New Mexico....535
U. S. Soldiers Improve Marksmanship by Firing Pin Projectile....538
Working Life of Big Guns Only Four Seconds..539
Adjustable Inclined Unloading Wharf....540
Lubrication Preserves Wire Rope....541
The Aeroplane Camera....541
Largest Gold-Ore Crushing Battery in World...541

[Continued on Page 6]

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Contents—Continued

Automatic Electric Target 542
Monster Clock with Electric Disk Dials....542
Special Telephone Device as Army Scout....543
Pumping Out a Submerged Mine....543
Steel Alloy for Telephone Diaphragms....543
Salving a Vessel in Ice Floes....544
Extent and Kind of Travel on Massachusetts Roads 544
Pneumatic Shield for Operations on the Lungs..545
French Destroyer with Turbines and Reciprocating Engine 545
Signaling Under the Sea 546
New Gas for Balloons....546
Heat, Part IX—Energy and Fuels....547
Ridding Seattle of Rats 550
Wicker File-Basket 551
Air Purifying Apparatus 551
Tension Straps for Feed Bags....552
Crew of Italian Cruiser Taught Jiu-Jitsu....552
Alcohol Engines on German Farms....552
Aeroplane Designed to Carry Passengers Inside..553
Improved Cigarette Paper Holder....553
Simple Oven for Gas Stoves....554
Suggestion to Trap Tire Stealers....554
Treating Nervous Troubles with an Electric Magnet 554
Light as a Burglar Expeller....555
Fly Escape for Screens....555
Long-Handled Concrete Sidewalk Trowel....555
Safety Trap-Door for Train Vestibules....556
Photographic Reproduction of Sound 556
Private Irrigation Within Salt River Project....556
Japanese War Fan 557
Cutter Aids Corn Eaters....557
Gold Fish as Mosquito Exterminators....557
Beavers Good Mechanics 558
Famous Scotch Bridge Restored....558
Curious Tricycle-Aeroplane 558
Horse Spectacles Result in High Stepping....559
The Flying Zephyr 559
Spacing Device for Planting Corn....559
Device Locates Auto Troubles....560
What Saddle Horses Should Carry....560
Combined Fireplace and Cooker....560
The Making of Arts-Crafts Lamps—Part III...561
Cost-Price Dentistry Good Philanthropy....562
Beautifying the Australian Railways....563
Protectors for Automobile Hoods....563
Replica of Spanish Galleon Built on Piles....564
Swimmer Killed by "Stingaree" 564
Autos Spread Gypsy-Moth Plague....564
Anchors for Chandeliers in California Clubhouse.565
Garden Furniture Made of Old Warships....565
The Norway Sea-Fish Hatcheries....565
Chinese Depository for Human Bones....566
The Wireless Phenomenon of Day and Night..566
Flying Shoes for Good Luck....566
Headless Twin-Cylinder Engine 567
An Automatic Horse and Cattle Trough....568
The Dwarfing of American Marine....568
Relics of Ancient Wars 569
Life of Vein Mines Unending....570
How to Make a Mission Bedstead....570
Old Flatirons Made New....571
The French Expedition to the Antarctic....572
Preventive of Scarlet Fever Complications....575
Cigar-Lighters for the Home 575
Automobile Street Sweepers 575
The "Aeroplane" Bait 576
Hongkong's Wireless Ordinance 576
A House Built of Lava 576

SHOP NOTES

Siphoning Water from a Pond....577
To Keep Varnish from Crawling....577
Joining the Limbs of a Tree....578
Coloring Iron and Steel for Laying Out Work..578
Protector for the Eyes While Grinding....578
A Dowel-Pin Gauge 579
Blacksmith's Bellows Made from an Old Tank..579
Makeshift Hook Lock 579
Home-Made Steam Trap 580
Breaking Large Bottles 580
Substitute Bowl for a Lamp....580
Removing an Automobile from a Ditch....581
Small Movable Hothouse for Plants....581
Hand Boring Bar for a Large Pulley....581
Home-Made Pattern Letters and Figures....582
Lead Pipe Connection Without a Wipe Joint....583
Housing a Clothesline in a Post....584
Preparing Plaster Walls for Papering....584
Wedge Vise for a Woodworker's Bench....584
Preventing Sore Hands Caused by Metal Developer 585
Holding Heavy Work in a Chuck....585
Adjustable Swing Table 585
Round Concrete Column Base Forms....585
A Paper-Holder and Cutter 586
Making Corncribs Rat-Proof 586
Centering Tool for Woodworkers....586
Renewing an Old Window Wiper....587
Home-Made Rubber Curry Comb....587
Door Mat Made of Old Ropes....587
Sanitary Chicken Roost 587
A Twist Drill Box 588
Inserting Small Screws 588
Driving Flies Away from a Screen Door....588
Cutting Glass Disks 589
Tool for Putting on Automobile Tires....589
Handy End Gate Clamp 589
Turning Tool for Large Wood Pieces....589
Finding the Break Horsepower....590
Protecting a Newly Painted Wall from Flies and Dirt 590
Forms for Cementing Coating on Walls....590
Keeping Wire Mesh from Sagging....591
To Clean Sink Pipes 591
Substitute for a Ratchet Wrench....591
Caliper for Hexagons and Squares....592
To Harden a Hammer 592
Graduating the Stiffness of a Brush....593
Combination Compass and Dividers....593
Lathe Dog with a Notched Grip....593
Measuring, Marking and Cutting Rafters....594
How to Make a Trouser-Hanger....595
Keying Foundation Timbers 595
Converting Quicksand Into Rock 595
Air Lock for Boats 596
Finding the Gradient of a Hill....596

AMATEUR MECHANICS

Home-Made Phonograph 597
A Novel Rat Trap 598
A Nut-Cracking Block 598
A Jelly-Making Stand 598
Woodworking for Beginners—Chapter VII....599
An Outdoor Gymnasium—Part III—The Horse..601
Spoon Rest for Kettles....602
Reason for Bursting of Gun Barrels....602
How to Make a Wireless Telegraph Set—Part IV 603
How to Remove Glass Stoppers....605
Telescope Stand and Holder....606
How to Make an Electrical Horn....606
Driving a Washing Machine with Motorcycle Power 607
Home-Made Aquarium 607

INTERESTING PATENTS, PRACTICAL OR UNIQUE

Combined Snap-Hook and Swivel....608
Window-Box Support 608
Perforated-Paddle Ball Game 608
Folding Camp Stove 608
Combined Dipper and Funnel 608
Combined Reflector and Shade 608
Unique Balloon-Flying Machine 608
Smoke Filter for Cigars 608
Movement-Cure Apparatus 608
Sweat Shirt for Hot Weather Wear....608
Cloth-Holder for Brooms 609
Pulsating Device for Milking Apparatus....609
Device to Teach Swimming 609
Combined Knife and Bottle-Opener....609
Improved Can-Opening Device 609
Method of Compressing Air by Moving Water..609
Meat and Fruit Press 609
Infant's Bathtub 609

Popular Mechanics

Written So You Can Understand It

Vol. 14 OCTOBER, 1910 No. 4

PADDLING LIFE PRESERVER

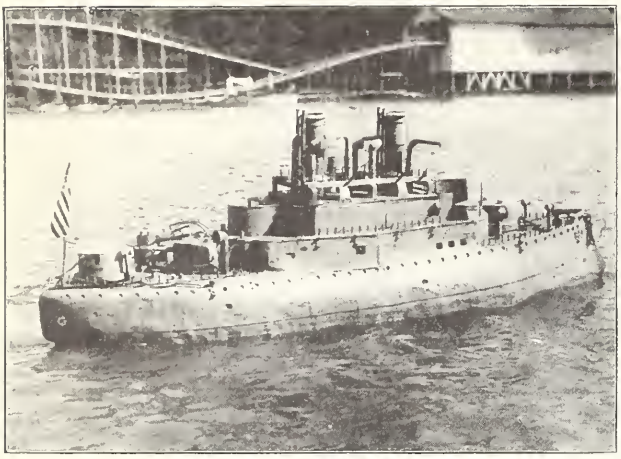
Back to the Shore with Rescued

Taking Down the "Sleigh Buoy"

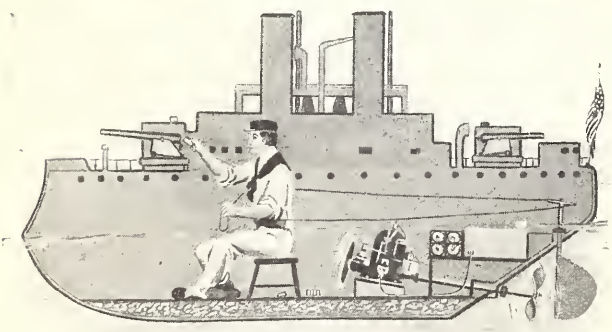
Running Down the Beach

A NEW life-saving apparatus, called the "sleigh buoy", which weighs only 15 lb. and can be easily carried on the run into deep water, then paddled to the person in danger, has just been brought out. It is particularly intended for bathing places, and it is claimed that by its use persons in danger of drowning can be rescued before a boat could be even launched and without risk to the rescuer, as a swimmer, trying to save a drowning person, is often a victim to the struggles of the one he would save. In a case of "man overboard" from a vessel, the "sleigh buoy", manned by one who could propel it, might double the chances of rescue as against an ordinary life preserver thrown overboard.

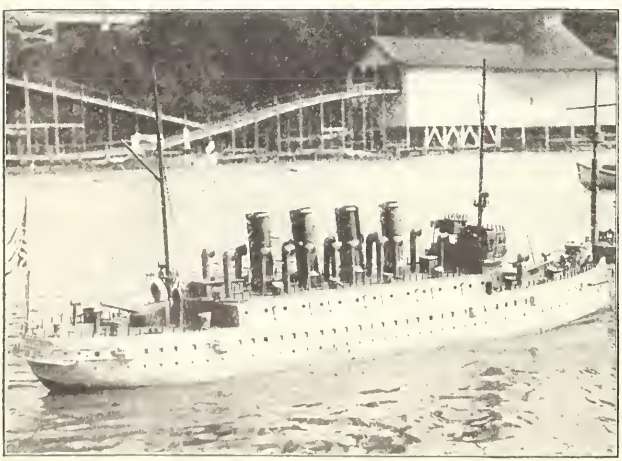
"LIVE" MINIATURE BATTLESHIPS



A Miniature "Dreadnaught"



Method of Operation



One of the Cruiser Class

Real "live" miniature battleships, ranging in size from 9 to 12 ft., each equipped with a 3-hp. gasoline motor, and with guns that fire singly or in broadsides, give realistic naval engagements on a miniature ocean near Cincinnati.

One man, seated in the interior of each ship, operates both the power plant and the guns. The gasoline engines used require but little care, so that the operator can devote almost his whole attention to the rudder ropes and cartridge guns. He enters by means of a movable turret, and his observations are made through the many small portholes.

The little battleships are constructed entirely of steel, and were built by a corps of naval mechanics, long in the employ of the navy at the Norfolk yard.

The cruisers "Birmingham" and "Salem" have gone on a trip to South American waters for a further test of the wireless telegraph apparatus with which they have been equipped. The first test, which took place in the Atlantic, off the Virginia Capes, was only partially successful. Modifications in the apparatus are being made with a view to insuring communication from the ships to the wireless station at Brant Rock, Mass., at a distance of 3,000 miles.

THE TELESCOPES OF THE ALPS

In many parts of the Alps are look-out stations provided with powerful telescopes through which parties making difficult ascents may be watched. In some instances the persons looking through them have been the first to note signals of distress and to send aid that has been the means of saving lives.

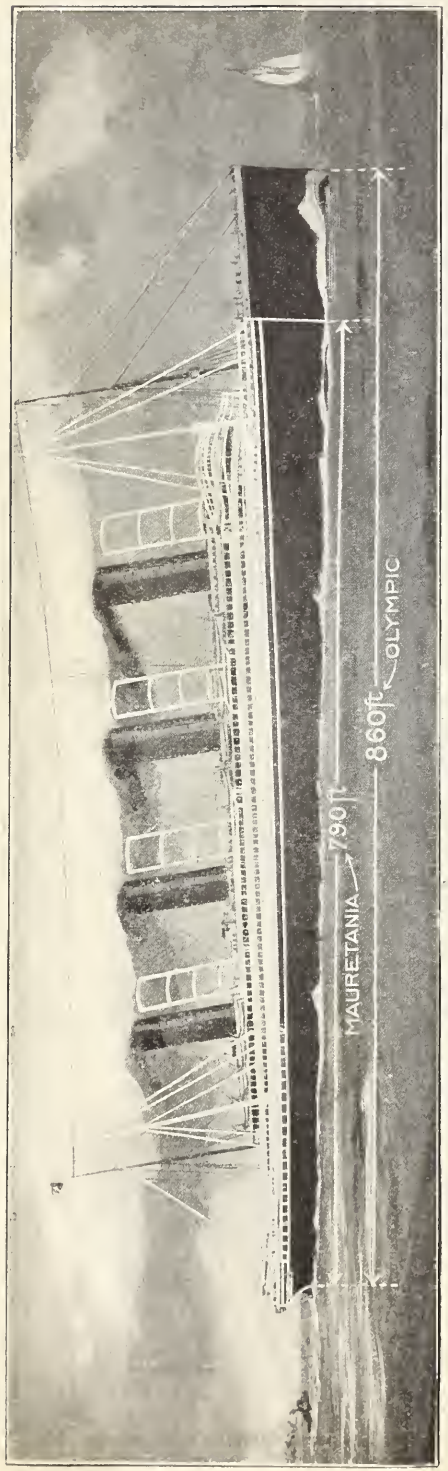
The instruments are nearly all 5 in. in diameter and 6 or 7 ft. long. They were erected by the mountain railways of Switzerland and are often used by members of parties who do not care to make the difficult ascents, but desire to watch their more venturesome companions do so. The climbers may often be brought so close that they may be seen cutting steps in the ice, placing their feet in them, and slowly mounting upward.

GLASS FROM SLAG

Slag obtained from various iron works in England is being made into glass by a concern in Liverpool. Proportions of sand and sulphate of soda, and in some instances a little lime, are put into the blast furnace, converting the ordinary slag into a glass that is available for slates, paving-blocks, bricks and tiles.

It is said that slates can be manufactured at less than half the expense of Welsh slate. They have a polished appearance, and can be made in any size and shape, and in many colors. A house roofed with it, so one

High Up on a Mountain Side—Watching Alpine Climbers



The "Olympic" as She Will Appear—Outline Shows Comparative Size of the "Mauretania"

source of information claims, could dispense with skylights, and even windows would not be required on the top floor.

THE COMING LEVIATHANS

The great transatlantic liners "Lusitania and "Mauretania," pointed to as the wonders of the seas since their maiden trips, will, at a not far distant date, have to give up the blue ribbon for immensity to the "Olympic" and "Titanic." These vessels will hold the honor for a more or less short period and then, in turn, will relinquish it to the two 60,000-ton leviathans of whose future building the Cunard Line has made announcement.

A complete description of the "Olympic" and "Titanic" is still impossible, as the White Star Line officials refuse to give out details. The length, however, will be in the neighborhood of 860 ft., the beam 90 ft., and the displacement 45,000 tons. The "Olympic" will be launched in October, if all goes well, and the "Titanic" will follow a little later.

PROPOSED PACK FOR U. S. INFANTRY

A new and much improved pack equipment for infantry soldiers, which accomplishes a reduction of 10 lb. below that now carried in the heaviest equipment, and 17 lb. in the normal equipment, has been recommended to the Secretary of War by the army equipment board, specially appointed for the purpose.

The first consideration of the board was the reduction in weight of the equipment now carried by the infantry soldier, which is 56½ lb. The second consideration was the arrangement of the load to be borne by the soldier in such manner as to reduce to a minimum the fatigue incident to its carriage, with the least interference with the arms and legs. In the present equipment, all the articles considered essential are attached to the belt, the result being a considerable amount of

interference with the legs, when marching. The blanket roll, carried over the shoulder and across the chest, is a great impediment to proper breathing.

In the proposed equipment, all articles, except the canteen and the first-aid pouch, have been removed from the belt and attached to the haversack, which is borne on the back, the bayonet being attached to the left side of the haversack, and an intrenching tool at the back. The blanket, poncho, and shelter tent are made into a short roll, which is attached to the bottom of the haversack.

Light Marching or Fighting Equipment — Heavy Marching Equipment

Articles of Proposed Infantry Pack

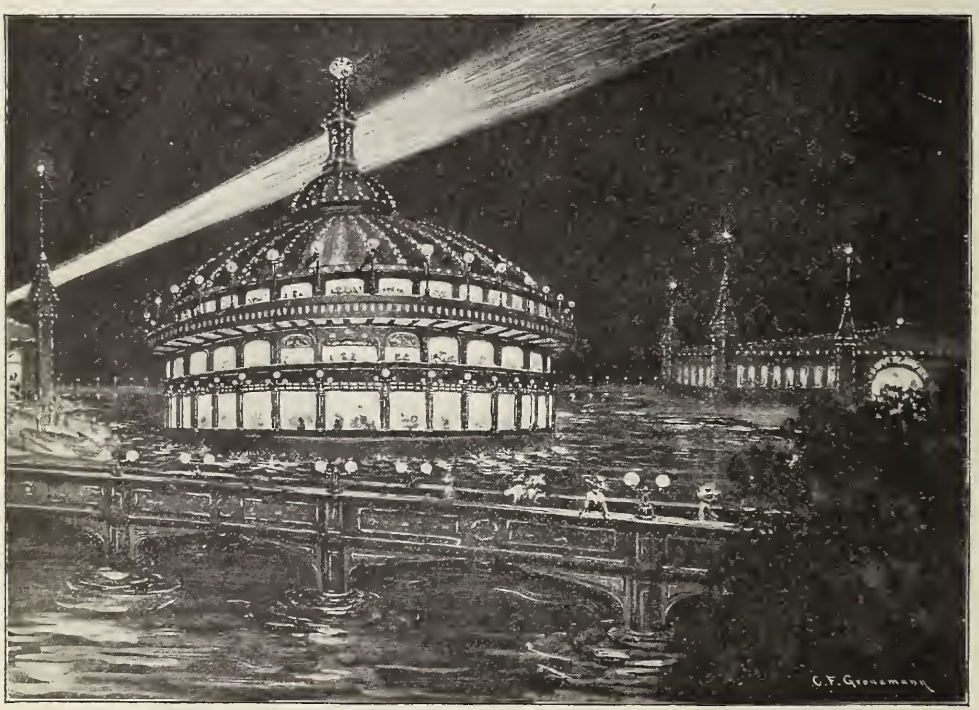
One important feature of the new equipment is the facility with which the soldier can divest himself of the articles essential to his health and comfort in the field, but not to his fighting efficiency, while in action. This can be done by simply withdrawing a coupling strap, which holds the back carrier to the bottom of the haversack, and unstrapping the hooks attached to the bottom of the pack, which falls off, leaving the soldier with his rifle, ammunition, intrenching tool, canteen, first-aid packet and poncho, and two days' rations.

Normally, the soldier will not carry the blanket, poncho or shelter tent, these being made up into a roll and carried on the company wagon. When cut off from transportation facilities, however, he will have to carry them, and at such times his equipment will weigh 47 lb., which, also, includes the weight of the clothing worn. The normal equipment weighs 38 lb., including clothing worn by the soldier.

The illustrations show the proposed pack open, except roll; the equipment with roll detached, which is the normal and fighting arrangement; and the heavy marching equipment.

REVOLVING CAFE FOR CALIFORNIA RESORT

Plans have been drawn and accepted for a unique seaside attraction at Santa Monica, Cal. It will be a revolving café. It will have a diameter of 110 ft. and the dome will be 55 ft. from the concrete piles. This pier, which is to be the largest pleasure structure of the kind in the west, will have a floor space of 280,000 sq. ft. The steel café is estimated to cost $45,000.



Makes Four Revolutions an Hour While Patrons Dine

water. The first floor will be stationary, but the second and third circular floors will revolve around a large central axis. The first of the revolving floors will serve as a café, and as four complete revolutions will be made in each hour, the dinner visitors will have an ever-changing scene of sea, city and mountain. The third floor will serve as a roof garden, and here a band will be stationed. The center of the device will not revolve, and on the café floor this space will be utilized as a kitchen. Nine thousand electric bulbs will light the amusement feature at night. The revolving dome café will occupy a position 900 ft. from the tide line, being constructed upon a pier of reinforced

INTERNAL COMBUSTION UTILIZED IN ANCIENT TIMES

It is a question in some minds whether the gas or internal combustion engine resulted in the practical automobile and motorboat, or whether the popular demand for horseless vehicles and power-propelled small craft resulted in the practical internal combustion engine. But, disregarding this fine question, it is positive that internal combustion was known and utilized in a crude way in ancient times.

"It is altogether probable," says the Water and Gas Review, "that the ancients possessed a greater knowledge of the effects of heat than has reached

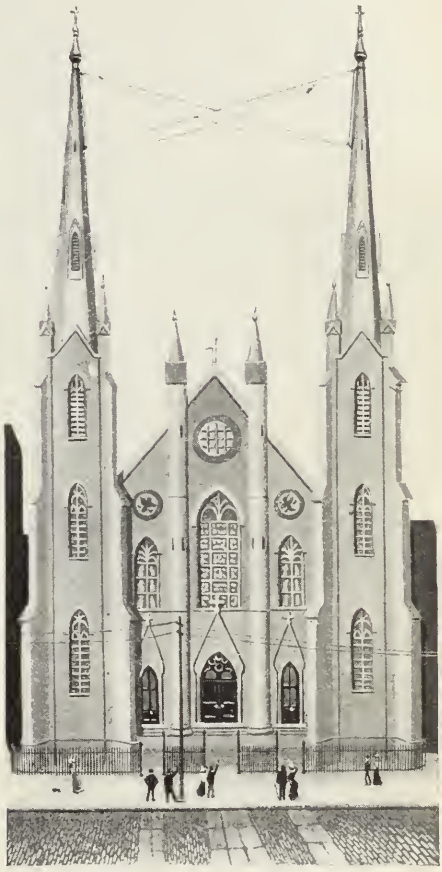
us in any permanent records. One of the earliest machines in which the action of heat was converted directly into motive power was not only a gas engine, but a gas turbine. The so-called 'smoke jack' used in medieval times to operate the turnspit before the fire consisted of a sort of screw propeller wheel, placed in the chimney and caused to revolve by the action of ascending gases, the motion being transmitted by means of gearing and belts to the spit. There are numerous instances of such devices, of which illustrations were made by the great painter and engineer, Leonardo da Vinci.

"About the first record of any patent covering gas engines, the one taken out in England in 1791 by John Barber, was for a motor which seems like an anticipation of present-day attempts to produce a gas turbine. Strange to say, Barber used gas produced by distilling wood, coal, oil or other hydrocarbons in a retort, the coal gas being delivered with the proper amount of air into an explosion or combustion chamber, where ignition took place and the products of the combustion were discharged against the buckets of the turbine wheel."

SLIDING ON CABLES HIGH IN AIR

While removing the crosses from the 150-ft. twin spires of the Church of the Assumption, Philadelphia, steeplejack Hassler slid over cables from spire to spire in company with his two assistants, while hundreds of people watched in amazement.

In commencing the difficult task, the men first climbed up the steep stairs in the interior of the spires, and, clambering out the windows, hitched themselves up the almost perpendicular sides a foot at a time until the top was reached. Rope ladders were then made fast and ropes were strung from one steeple to the other. It was these ropes that the steeplejacks used as a means of getting from spire to spire, choosing this method rather than climbing down one and then up the other when a change of working base was necessary.



Steeplejacks Traveling from Spire to Spire

Seated on a strip of board suspended from a light rope, they slid back and forth with less thought or trouble than some people would have in crossing a street.

The distance between the spires is 80 ft., but the distance traversed was considerably longer, due to the slant of the traveling cables. Hassler believes that he is the first to ever adopt aerial cables as a means of getting from spire to spire.

¶Automatic electric controls have been installed in wasteways placed at two-mile intervals along the main canal of the Yakima, Washington, irrigation project, to prevent overflows.

Copyright, Boston Photo News Co.

Artistic Plaster House Owned by C. Haskins, Quincy, Mass.

A GROUP OF OFFICIALS OF FUHKIEN'S FIRST RAILWAY
Third from the Left, Mr. Cheng Hsu, Manager; Fourth, Mr. Wong Hui Nan, Chief Engineer; Fifth Mr. Chun Bao Tsun, President

China's First Really Chinese Railroad

Native Capital, Engineers and Laborers Constructing Line from Amoy to Changchaufu Under Peculiar Conditions

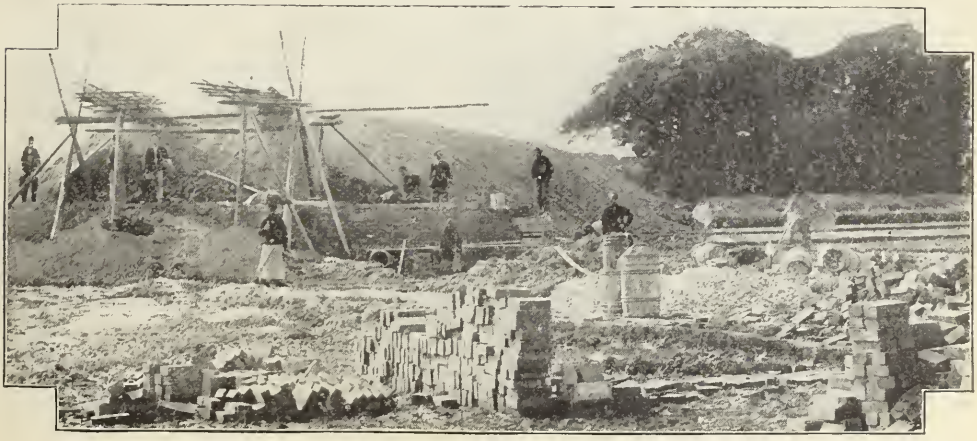
By ARTHUR E. BURRAGE

THE greater railroad projects of China, both by reason of their supreme importance to the commercial development of the Empire and because of the expanded field for financial operations, have so completely engrossed the attention of foreigners that the smaller enterprises have been correspondingly neglected. Among these lesser railways is the Amoy-Changchaufu line. This is one of the first of the 13 railways now being constructed in China on the basis of "everything Chinese." The engineers are Chinese, though foreign trained, the capital, Chinese, the entire management, Chinese, and, so far as possible, the construction materials and rolling-stock, Chinese.

The scheme was first projected in 1906 and took definite form in 1908, when a group of local capitalists secured a charter from the Yuch'uanpu, Ministry of Posts and Communications, in Peking, and became formally organized under the name of the Fuhkien Railway Company. The capital stock of the company is $3,000,000*, divided into 600,000 shares of $5.00 each. The local gentry have subscribed for a

* *All values are given in "Mexican" dollars. One of these dollars is usually worth about 50 cents gold.*

A Typical View Along the First Really Chinese Railroad—Just Beneath the Tree in the Center is a Repaired Grave
The Railroad Station at Sungsu, the Amoy Terminus
A Granite Culvert, Typical of Those Along the Road



The Adz, the Pick, and the Basket, but no Shovel or Scoop
A Deep Cut through an Undulating Section of Country
Chinese Constructing False Work at the End of a Fill

large portion of the stock, any and all being permitted to purchase. The Imperial Government has also purchased a large block. Payments were to be made on the basis of 20 per cent the first year and 40 per cent the second and third years. In order to insure the uninterrupted construction of the road, in addition to paying on its stock, the Chinese Government agreed to loan the company, through the Kao Tung Bank, a government institution, such money as became necessary before the entire capital stock had become paid in; the company agreeing not to negotiate any foreign loan.

The surveyors ran their lines in 1907, actual construction beginning in the following year. Amoy being located on the island of Amoy, it was necessary to locate the terminus on the adjacent mainland, the two to be connected by a ferry when the road is put in operation. Starting at Sungsu, the road runs along the north bank of the Hailing (Sea Dragon) River to Changchaufu, a city of half a million people, situated on the west branch of the Hailing, 100 li* from the coast. The present plans include an extension of 800 li, running southward to Chaochowfu in the province of Kwangtung, where it will connect with the railroad from Swatow and be one link in the future coast line to stretch from Kowloon or Canton to Shanghai. It is also anticipated that the road will be extended farther into the interior of the province of Fuhkien, connecting with the Swatow railroad at or near the place where that road joins the Canton-Hankow railroad.

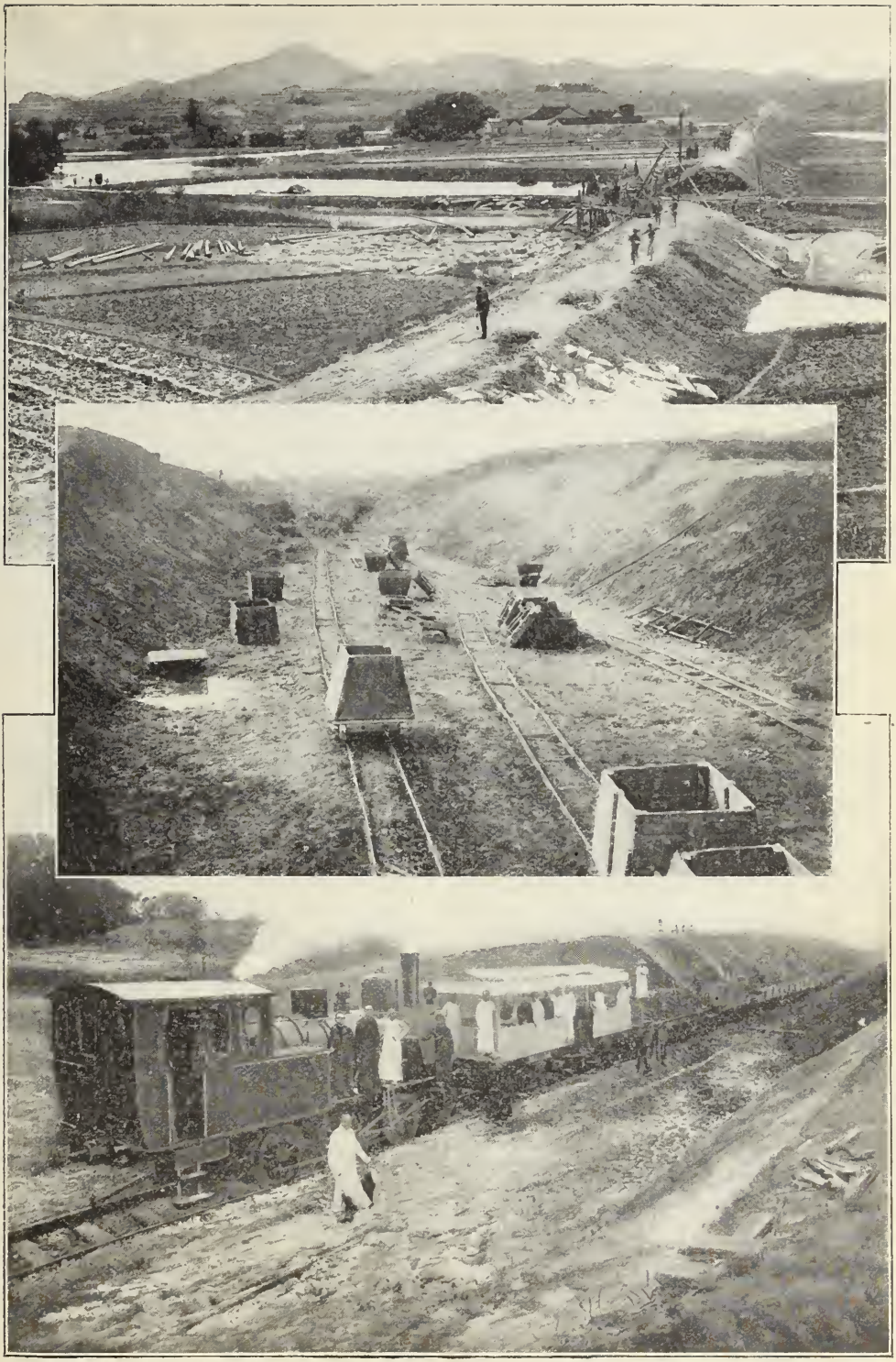
Near the middle of one of the fills there was an example of a peculiar difficulty which a railroad constructor in China must meet. A well-cemented granite culvert arched over what at first appeared to be only a foot path, but closer inspection revealed a well. As the greater portion of the population of China obtains most of its water from the many wells scattered about the villages, the sources of supply are usually carefully guarded. This particular well was dug more than 1000 years ago. It has never run dry and no matter what the condition of the other wells of the village may have been, this well has never been the cause of the least alarm. When the surveyors announced that their plans required the filling of this well, the entire community vehemently remonstrated. The only solution was the granite culvert, greatly augmenting the expense. Such disputes as this are by no means uncommon. In fact, when the road was started, the treasurer of the province appointed an arbiter, whose sole duty is to investigate and adjust all disputes.

The chief engineer, Mr. Wong Hui Nan, was a student at the Arsenal School at Foochow, China, and later studied engineering in France. Returning to China, he became assistant engineer in the construction of the early roads being built in the province of Honan and later became connected with the Peking-Hankow railroad, with which road he was associated when he accepted his present position.

The rolling-stock consists of two locomotives, one German and one American, and eight flat cars bearing the nameplate of a Pennsylvania car works. There are trucks and platforms for others in the yard awaiting assembling, but the passenger cars have not yet arrived. The trucks for these have been made in America, but the entire superstructure will be the work of the Chinese, using foreign designs. They are being constructed at Tung San, province of Chihli, and are expected in Amoy before the close of the present year.

The weary coolie, among his tufts of rice, pauses for a moment as he hears the strange innovation, called "fire-train" in his language, moving on its way. Dotted along the muddy river are a dozen junks, each an element in the commerce of a great delta. Just faintly can we see the patient coolies toiling at the oars, for the wind is low and the great square sails flap idly in the midday calm. Swinging to their sing-song rhythm, these rivermen sway backward and forward, moving their

*A "li" equals 654 yd.



At the Extreme Left of the Upper View Is a Sedan Chair, the Old Mode of Travel in China—A Fill in the Foreground
The Hopper-Shaped Cars Used for Carrying Dirt
A German Locomotive, an Observation Car, and a Load of Dirt on American Flat Cars

heavily-laden craft up or down the river, never seeming to fear the new creation which may some day make their occupation too unprofitable.

On either hand are numberless graves, even jutting out almost to the roadway. These have formed and always will form, so long as ancestor worship endures, a large part of the trials of the Chinese railroad builder. If the descendant be poor, the removal and reburial of the bones and a money consideration, will gain the permission to lay the tracks; but if the present keeper of the ancestral tombs be wealthy, and especially if he be among the influential men of the community, no amount of money will be sufficient to gain the permission to remove the remains. A bridge or a culvert will not aid, a detour only will allow the road to advance. Such is the cause of certain otherwise unexplainable curves in the road.

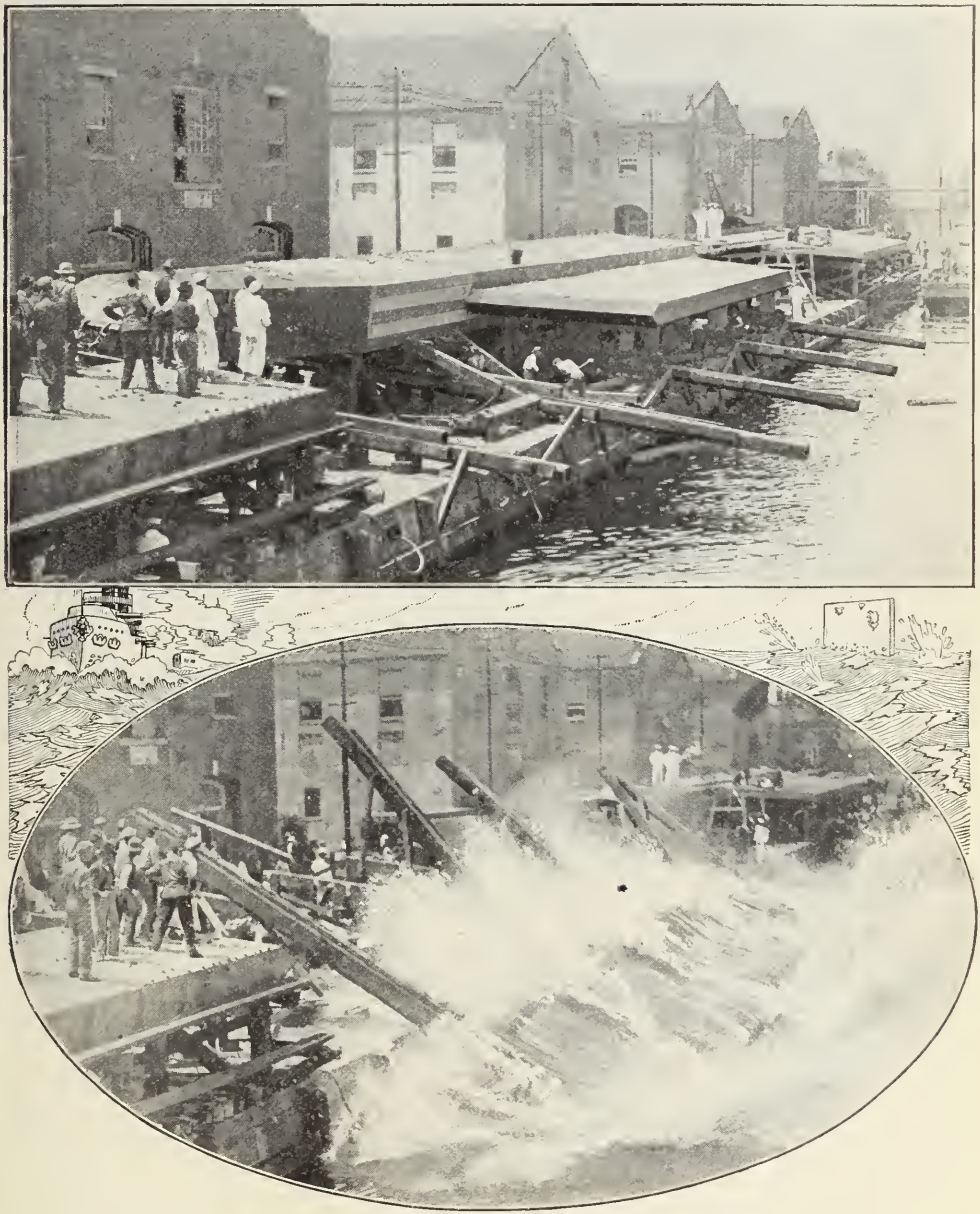
The method of construction of a road in China is exceedingly interesting. There is, here as elsewhere, much cutting and filling to be done, but here there are no steam shovels, no derricks and not even plain hand shovels. China is essentially a land of hand labor. The great cuts along the line were all made by hand labor. A few picks found their way to these parts, but, as a rule, the laborers used a flat tool much like a carpenter's adz, though somewhat longer and broader. This acts as a cutter to cut away the clayey soil and also as a hoe to put the dirt into the little bamboo baskets. The baskets hold about a large spadeful of dirt. The coolie, if the cutting be far from the car or truck, fastens a basket upon either end of his shoulder pole, balances, and then runs, with peculiar, characteristic dog-trot to the car. At times, when there is a great deal to be carried a long distance, the flat cars and the engines have been utilized, but by far the larger portion of the materials has been scooped into these baskets and carried to the little hopper-shaped cars which run on the portable track. The cars are but platforms, 3 ft. wide and 4 ft. long, upon which adjustable hopper-shaped sides are placed. The car having reached the fill, the hopper is lifted from the end and allowed to fall over backward, the contents falling, not as they do from the ordinary "V"-body dump-cars, but rather as from the contractor's adjustable-bottom four-wheeled wagon, directly beneath the car.

When a large mass of rock is to be excavated, powder is used, but instead of convenient, light, industrial derricks to remove the fragments, the coolies continue to work away on the vibration theory until the blocks are in sufficiently small pieces for them to lift and place upon the car. The process may be slow, but it is a question in a land of supremely cheap labor, whether such methods are not the most economical.

When the road was first contemplated, there was apprehension lest the necessary laborers might not be secured. The coolie population in the vicinity of the proposed line had heard the story, which they interpreted literally, that the Union Pacific was built upon the dead bodies of 5,000 laborers. They had also heard that the road had been built, largely, by Chinese labor and they reasoned that the material for making a good roadbed in America would be likely to make equally good material in China. In consternation, they came to an American and inquired about the truth of the story. It was only after a long and patient explanation that it was possible to convince these excited men that the actual facts were at variance with their notions. Today, the 2,000 men drawing their 40 cents a day are not at all worried about becoming eternal sleepers for the road.

¶Experiments in refrigeration are planned by French scientists at the new station established for the purpose at Chateaurenard. Comparative tests will be made of apparatus from every part of the world.

NEW TYPE OF U. S. NAVY TARGET RAFTS



Target Rafts Under Construction—How They Are Launched

The new type of platforms or rafts for the bearing of the targets at which the U. S. battleships fire in practice are of very solid and formidable construction. They are 150 ft. in length, and 10 ft. wide, having an upper part or deck built of heavy square timbers, strongly bolted together. The bottom part or keel consists of an immense steel tank, resembling to some extent the fin of a

New Combination in Locomotive Power

Courtesy Engineer, London

racing yacht. This tank is filled with pig iron to overcome the great resistance the target screens offer to the wind. The screens, four in number, are suspended from masts rising to a height of 25 ft.

The illustrations show two of the rafts under construction at the Norfolk navy yard, and the launching of one of them. They are built on their side, and are launched by tipping into the water, the inboard side being raised by means of hydraulic jacks.

COMBINED CIGAR-LIGHTER AND GAME OF CHANCE

This donkey cigar-lighter is a game of chance as well as a producer of flame, and was designed for cigar stores. The pack on the back of the animal has a circular hole in the top, and by dropping into this a marble taken from the basket, either the head or tail will be made to waggle. Just which, depends purely on the channel the marble takes.

¶A curious analogy between the plant life found in the Holy Land and in California has been discovered by experts. The flora of Palestine includes about the same number of species as California—3,000.

STEAM TURBINE-ELECTRIC LOCOMOTIVE

This new type of locomotive, built for the Reid-Ramsay railroad system in Glasgow, Scotland, and recently tried out, is driven by electric motor, the power for which is generated by a steam turbine.

Steam is generated in a boiler of the ordinary locomotive type, fitted with a superheater. The coal and water supply are carried in side bunkers and tanks, located along each side of the boiler. The steam from the boiler is led to a turbine, which runs at a speed of 3,000 revolutions per minute, and to this is directly coupled a continuous-current variable-voltage dynamo. The dynamo supplies current and pressures varying from 200 to 600 volts to four traction motors, the armatures of which are built on the four driving axles of the locomotive.

The exhaust steam from the turbine passes into an ejector condenser, and is, together with the circulating condensing water, delivered eventually to the hotwell. As the steam turbine requires no internal lubrication, the water of condensation is free from oil. The water evaporated by the boiler is therefore returned to the boiler again and again, and the water carried in the tank is actually circulating water for condensation purposes. The condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast which induces the draught through the fire-box and boiler tubes, but the induced draught is replaced by forced draught provided by a small turbine-driven fan.

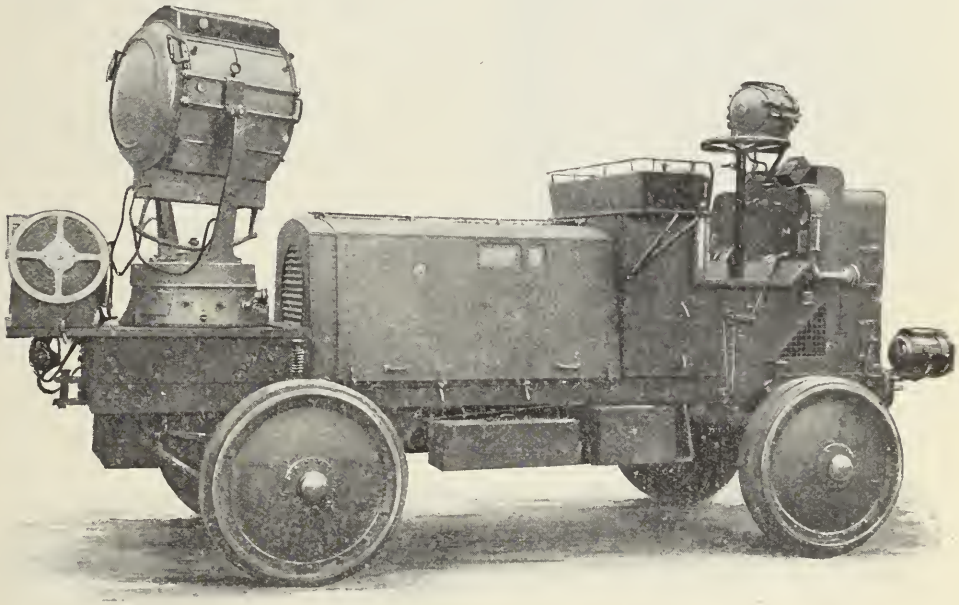
UNITED STATES ARMY SEARCHLIGHT AUTO

Motor searchlights of both the English and French armies were described and illustrated in the August issue, while this article deals with the monster searchlight just acquired by the United States army. Like the foreign war vehicles of the same kind it will be used for spying out the enemy at night, both land and aerial fighters, but especially the latter.

Ready for action, the machine will weigh 10,500 lb., yet it will be able to negotiate a 25 per cent grade, travel 16 miles an hour, be run over soft ground, and climb over such obstacles as 10-in. logs.

The power and method of applying it, although described in this magazine as used on heavy traffic trucks, is unique for army service. The power is electricity, supplied to the motors from a storage battery, or generator, operated in turn by a gasoline engine. Each wheel is self-contained. That is, there is a motor in every wheel, making each one a driving wheel, while all four steer simultaneously. The same plant that furnishes power for propulsion, also furnishes a sufficiently powerful supply of current for two large searchlights, the rays of which will penetrate the darkness for a distance of several miles.

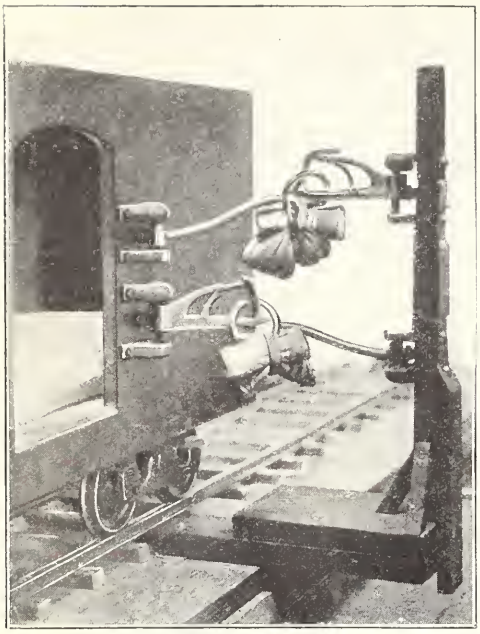
Each wheel of the truck has a knuckle joint, which enables the operator to turn the car in a complete circle in a space having a diameter but little larger than its length. The wheel casings, which contain the motors, are waterproof as well as dustproof.



Monster Motor Searchlight of United States Army

ILLUMINATED PROJECTILES

That the ability to trace the flight of shells during night firing would be of great benefit for correcting ranges has led the British army to make experiments with means of providing such projectiles with illumination. At Fort Albert, on the Isle of Wight, tests have been made recently in connection with 12-lb. guns of an invention that proves very satisfactory. It consists of a metal cylinder containing a powerful illuminant, and is screwed to the base of the shell. The illuminant is fired by the explosion, and burns brightly during the flight of the shell.



A Promising Mail-Transfer Apparatus

"GIVE AND TAKE" MAIL-CATCHING APPARATUS

A new bag exchange system for mail cars in transit, which has been given a test on the Illinois Central Railroad, is based on the use of pivoted arms. The apparatus is of the "give and take" type, and the exchange of bags is made by pivoted arms that release and catch the rings to which the bundles of bags are attached.

Fastened to the door of the mail car is an arm for delivering the pouches and a grasping device for receiving them. The bundle of pouches to be delivered from the car is strapped to a ring which is provided with a short spur that fits into the end of the delivering arm. As the car passes the station, the ring is caught by the grasping device on the post, the spur pulls out of the delivering arm, and the bundle of pouches is left behind. In receiving mail on the car, the same process is carried out, except that the action is reversed. Both the delivery and receipt of mail is accomplished simultaneously and without jar, a sharp click indicating the accomplishment of the transfer.

SINGING TAUGHT IN SCHOOL BY PHONOGRAPH

The children of Public School 147, Brooklyn, are taught proper tone and expression by listening to a phonograph installed for this purpose. The song being taught is written on the blackboard, the music studied, and then a record of it is played. The pupils listen to get the tone and expression; then it is played a second time, the pupils accompanying, singing softly; after which the phonograph is stopped and the song is sung from the music on the board.

AN ARTFUL INTERIOR-DECORATION ILLUSION

A person walking into this foyer of a New York restaurant would be surprised if told that the central feature of the decoration scheme was only half there and the rest an illusion, yet this is the fact. What appears to be a globe and table are each but half a table and half a globe, the other half, together with the rear wall, being supplied by the mirrored reflection. The mirrors are so artfully disposed that no joining is apparent.

Courtesy Upholsterer

Excellent Mirror Illusion

AUTOMOBILES BLAMED FOR SPREADING TETANUS

It is suggested by the British Medical Journal, that the extraordinary increase of tetanus in that country is due to the automobile, although the first thought is that the development of the horseless vehicle would have had just the opposite effect. But it is believed now that the distribution of the germs has been greatly increased by the dust-raising powers of the automobile.

In 1901 the number of deaths in England and Wales from tetanus was 57.

In 1902 an extraordinary increase occurred, the deaths being 201. In 1903 the deaths were 257, and the rate remained above the 200 figure until 1908, when it receded to 180.

NEST ON TOP OF STREET LAMP

The top of an arc lamp is not the best place in the world for a bird's nest, yet two sparrows, in search of a site for a home, selected just such a place, as is here shown. They built the nest right on top of the live terminals, and inside the resistance frame. In this position it was sheltered from wind and rain, and warmed by the resistance. Young birds were in the nest when discovered.

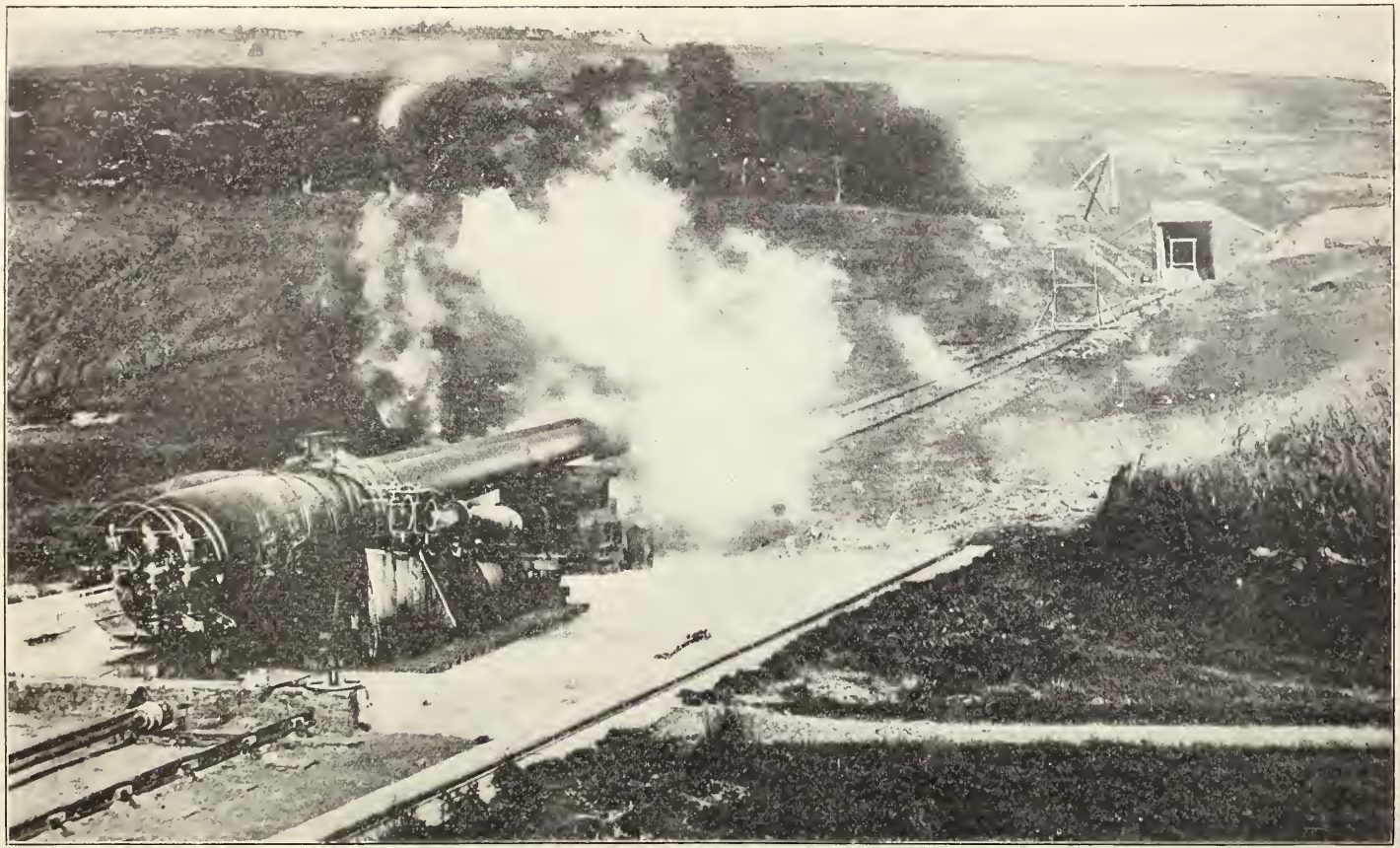
Sparrow's Nest in Arc Lamp

Built on Top of Live Terminals

FOREIGN BODIES LODGING IN THE HEART

The astonishing tolerance of the heart for a foreign body loose in its interior is remarkable. Pointed objects, however, generally work into the heart wall and cause such disturbances that an operation to remove them is justified.

Dr. D. G. Zesas, of Leipsic, has found 118 cases on record of foreign bodies in the heart. In these, 54 of the intruding objects were needles, 38 were bullets, and among the others were nails, a thorn, a gold plate, an iron peg, a splinter of wood, and a hairpin. In 12 cases the foreign body had reached the heart from the alimentary canal, in four cases through the blood vessels, and once by the air passages, while in 96 cases the entrance was by propulsion through the chest wall.



Photographic Image of Gun Vibration—Note Movement of Gun in Recoil

THE VIBRATION OF BIG GUNS

The movement of a 12-in. gun, caused by the explosion of the monster charge required to hurl the heavy projectile, is graphically shown in this illustration. The gun was photographed just before firing and then another exposure was made on the same plate at the moment the gun was discharged. The difference in the two images denotes the extent of the vibration. Another interesting feature of the illustration is the fact that somewhere within it, between the muzzle of the gun and the right margin, the projectile is rushing along its course. Had it reached its destination, the right side of the illustration would be a cloud of sand.

The tests were made at the Ridsdale proving ground of the Armstrong Company, in the middle of Northumberland, England.

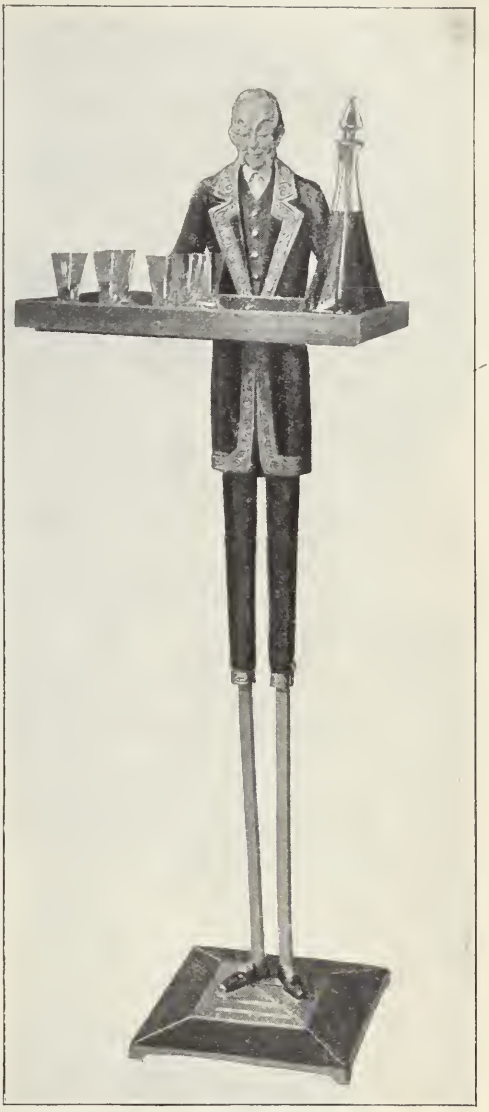
UNIVERSITY HAS GRADUATE COURSE IN HOUSE DECORATION

The Teachers' College of Columbia University has a course in practical house decorative study, the successful graduates from which receive a diploma. The preparation for this diploma requires two years' study at the Teachers' College, followed by an additional year of practical work with professional decorators under the supervision of the college instructors.

The studies include art appreciation, the history of art, history and principles of design, design drawing and painting, mechanical drawing, clay modeling, house decoration and furnishing, and construction.

IRON SERVING MAN

Quaintly fashioned iron waiters, patterned after the black-coated servant in human form, have come into vogue in England, having been brought into that country from Germany, where they were invented. These iron serving men carry trays on which are placed cigars, cigarettes, matches, coffee and liquors, from which patrons of hotels and cafes may help themselves. The iron men are placed in halls, and lounging and smoking rooms. They stand on pedestals and have casters so that they may be wheeled about. They are so light that a man can carry one under each arm.

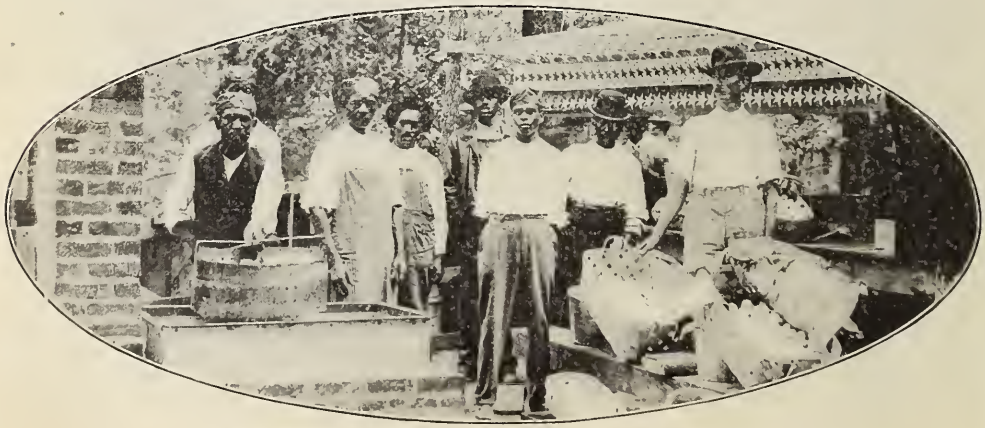


He Never Accepts Tips

Watermelon Shed at Picnic Given by Southern Mill Owner to 16,000 Employes and Friends—A Car Load of Melons Was One Item on the Menu

How a Mill Owner in the South Creates Efficiency and Contentment in His Employes

THE human asset is looming larger and larger in the industrial field. That the care and attention shown the engines and machines, the sums paid out for protection against loss by fire or other catastrophe form but a part of the insurance of any well organized plant against decreased dividends and depleted capital, is now almost universally recognized. The progress that has been made in this direction, during the past few years, however, and the extent to which the employers of labor have realized their responsibilities



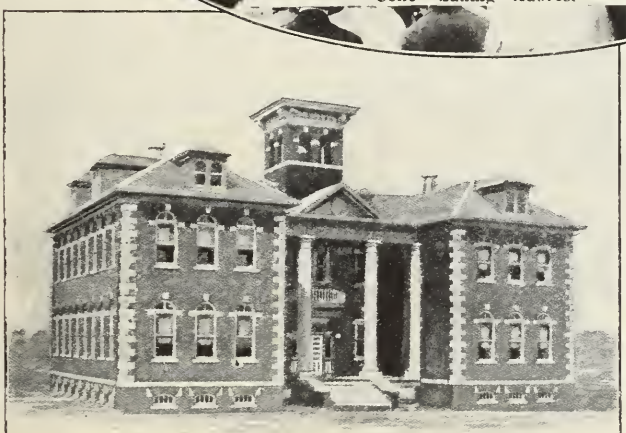
The Egg Boiler—18,000 Eggs Were Boiled and Served to the Picnickers

forms a chapter of industrial history that has been but lightly touched upon.

Throughout the South there are hundreds of men and women working solely to improve the condition of the human asset in the country's commerce. While a number of these welfare workers are the agents of societies organized for the purpose, by far the larger portion of them are the employes of the manufacturers, and are engaged for the purpose of keeping the laborer at the looms or in the mines happy, contented and prosperous for the same reason that a competent engineer is engaged to keep the engines running smoothly and the bearings properly packed. There is no philanthropy in this work. It is purely a business proposition for the men who have done it, and the material profits

A Four-Room House Which Rents for $3 a Month

Scene at Picnic Given to Mill Employes—Caesar Cone Making Address



The $25,000 School Building, Constructed and Largely Maintained by White Oaks Mills

of the system have been great enough to prove its practicability.

A leader in the movement for better labor by creating better conditions under which the laborers work, whose system is typical of those of many other mills and factories, is Caesar Cone of Greensboro, N. C. Mr. Cone is the head of a concern that owns and operates three large mills for the production of denim and canton flannel. He has 3,800 employes on his payrolls and 10,000 people are supported by the labor. His first step in the plans he and his brother, the late Moses Cone, made for the advancement of the workers' interests, took the form of constructing sanitary and attractive homes. There are several classes of these buildings, renting for from $3 to $5 per month and having from four to six rooms. Each house has its little garden plot and prizes are offered the householders who make the most attractive flower gardens, the best vegetable gardens and the best lawns. At each of the three mills is a school building, a corps of 30 competent teachers being in the employ of the company to give proper instruction to the children. At the White Oaks Mills the schoolhouse cost the firm $25,000. Welfare workers have organized cooking and sewing classes and classes for instructing mothers in the care of small children. Each mill settlement has a library which also supplies a place of recreation equipped with games of all sorts. There are gymnasiums and baths.

These necessary things constitute only a part of the investment the Cone interests make in humanity. There are numerous little celebrations of more or less elaborate character and at Christmas and on the Fourth of July the entire corps of employes and their families in each of the three mills are inoculated with the holiday spirit at the expense of the employers. Each family receives a load of wood or a turkey on Christmas day and money prizes are presented for faithful attendance at the mills. A big Christmas tree is erected in one of the mills and all of the children receive presents.

Every summer a big picnic is given and all the employes and their families are invited to attend. At the picnic held recently there were nearly 16,000 people present. The entire day was spent in enjoyment at the expense of Mr. Cone. He supplied a spread which was served by 150 waiters and included 10,000 frankfurter sausages, 18,000 boiled eggs, 10,000 buns, 10,000 sweet cakes, 10,000 sour pickles, 10,000 sweet pickles, 5,000 bags roasted peanuts, 10,000 slices watermelon, 1,000 muskmelons, 2,000 pineapples, 10,000 peaches, 40,000 bananas, 1,000 gal. lemonade and 25,000 saucers ice cream. There were three band concerts and a vaudeville performance during the day. The bands were made up of employes of the mills and the performers in the vaudeville were professionals hired for the occasion. In the afternoon there was a big meeting when Mr. Cone and his chief lieutenants made addresses and $500 in prizes was distributed among the workers.

Asked if all this expenditure pays, Mr. Cone points to the fact that he and his brothers have never had a single labor disturbance in the history of their enterprise. They started in the manufacturing business in Greensboro 20 years ago and now have one of the largest plants in the country. Their big mills have never been idle a day.

THE ADVERTISING OF AERIAL CRAFT

One cannot help but wonder in looking through the advertising sections of the magazines at the stupendous amount of space, costing millions of dollars a year, utilized by the various automobile and attendant concerns, yet

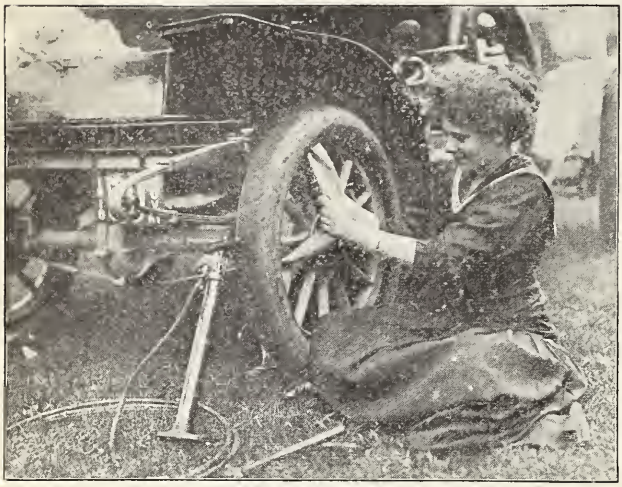
MONOPLANS
HANRIOT Company Lte
54 Rue des Moulins REIMS
Cet appareil monté par le pilote LOUIS WAGNER a exécuté le 10 MAI plusieurs vols magnifiques dont 1 avec 3 passagers sur l'AERODROME de la CHAMPAGNE
LES AÉROPLANES DE LA MARQUE HANRIOT SONT VENDUS PAR LA
BANQUE GÉNÉRALE
DE L'INDUSTRIE AUTOMOBILE
ET DE L'AVIATION
74 Bd HAUSSMANN
PARIS
AGENTS EXCLUSIFS POUR LE DÉPARTEMENT DE LA SEINE
TÉLÉPHONE 168-15
TELEGR MOTORBANK
Pour les leçons de pilotage qui sont données sur l'AÉRODROME de la CHAMPAGNE s'adresser au MONOPLAN HANRIOT 54 Rue des Moulins à REIMS ou au siège de l'AÉRODROME 17 B. de la République REIMS

Aercplane Advertisements in a French Weekly

it is foretold by many who have their eye upon the future that aerial craft will be advertised just as strenuously within a few years.

As yet, in this country, such advertising is mostly confined to magazines dealing with aerial developments alone, but in Europe, and especially France, space is being bought in weekly and monthly magazines of the general order. Examples are shown in these reproductions of three advertisements which appear in the foremost French weekly, "L'Illustration."

THE WOMAN AND THE CAR



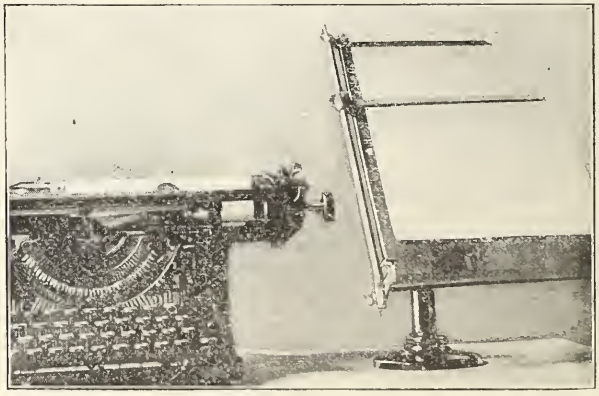
Repairing a Puncture

A year or so ago a light weight type of automobile known as a "gentleman's roadster" made its appearance and was hailed with favor, but the name has now ceased to be appropriate, as such cars, through recent developments in automobile simplicity, are ideal for women's use.

In the illustration a woman owner of such a car is busy repairing a puncture, and seems to be enjoying it. The majority of women auto owners are fairly good mechanics.

COPY-HOLDER WITH LINE INDICATOR

This holder for copy for stenographers differs from the ordinary device for the purpose in that it is provided with a line indicator. When the typist reaches the end of a line in reading the copy, a key, similar to one of the typewriter keys, is touched and the indicator drops to the margin under the next line, where it is held by a stop.



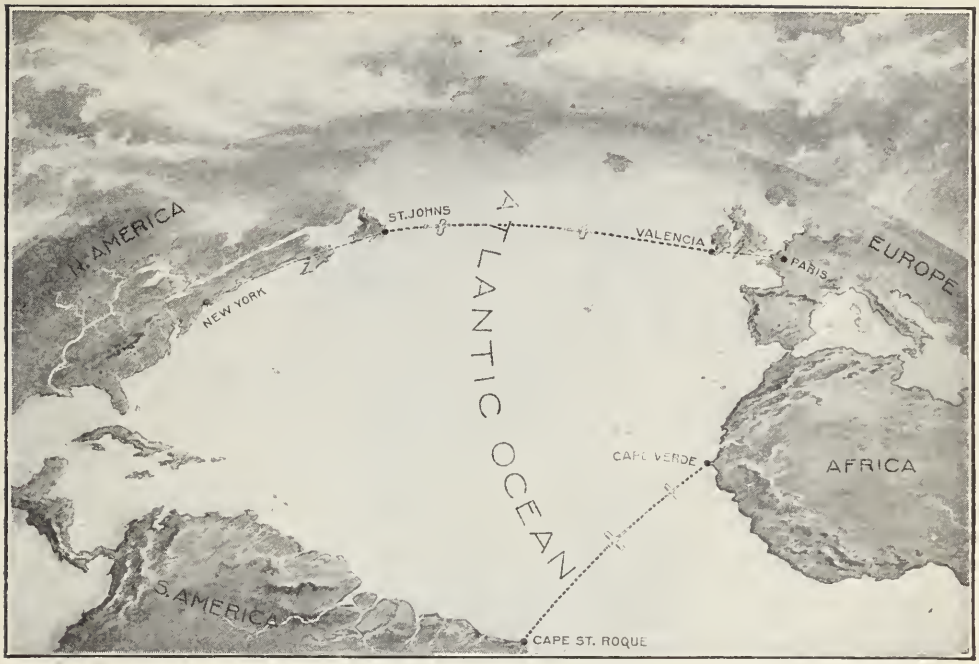
An Improved Copy-Holder

¶After months of discussion and experiment, the French government has decided not to adopt aluminum coinage because it is too light and will slip through the fingers unnoticed. Experiments are now being conducted with bronze containing 10 per cent of aluminum, which, if adopted, would reduce the weight of coins about one-half.

¶A municipal dry dock, 1,000 ft. long, has been proposed for New York.

GROWTH OF THE WORLD'S SHIPPING

The total tonnage of the world's shipping is now 41,915,000 tons, of which 37,291,000 is steam, and 4,624,000 sail. The growth in shipping from 1886 to 1910, and the supremacy of steam over sail, are shown by the following figures: In 1886 the tonnage of sailing vessels was 11,217,000, and of steam vessels 10,291,000. In 1900 the steam tonnage was 22,369,000 and the sailing-vessel tonnage 6,674,000.



Shortest Routes for a Transatlantic Flight—The Distance by the Northern Route Is 1,760 Miles and by the Southern Route About 1,800 Miles

ACROSS THE ATLANTIC IN AN AEROPLANE

By VICTOR LOUGHEED

Author of "Vehicles of the Air"

NEVER in the history of mankind has an improvement in transportation or progress in a mechanism appeared so suddenly or developed so fast and so utterly unexpectedly as has the aeroplane. Born while the world was looking the other way, and nurtured in a cradle of skepticism, the new vehicle of the skies has been minimized, poohpoohed, and jeered at, by savants and laymen alike. The result has been that an amazed world has had fairly sprung upon it, quite in the face of doubt and disbelief, the most astounding spectacle of the ages—the wildest dream of the dreamers come true, for centuries upon centuries the very synonym of all that was extreme and impossible—the man-bird, at last, full-fledged, with his self-built pinions of steel and wood and fabric, mounting triumphantly into the blue in ever-increasing numbers. Flying for hundreds of miles and for hours upon hours, cutting evolutions with the grace of the gull and gliding with the sweep of the eagle, beginning close to the ground, over level areas, and then daring to mount to the cloudland realms of the condor, he has piled record upon record and achievement upon achievement.

What yesterday was a feat proclaimed the world over, is today unnoticed and commonplace. It is accepted fact that men fly, surely and boldly, and with increasing safety, even though they pay with the martyrdom of an occasional life for some particularly hard or especially needed lesson. It remains no longer to establish the mere ability to fly; the question now is the probable measure of the practical limits and values of man-flight in the reasonably near future.

It is little more than a year since Bleriot's crossing of the English channel riveted the attention of the wondering nations. Since then the same span of water has been successfully crossed four times, the last crossing having been a mere incident in Moissant's trip from Paris to London. A year ago the record altitude achieved by an aeroplane was less than a thousand feet. Since then two machines have mounted over a mile into the clouds, and any number have broken last year's record. A year ago the record distance for a single flight was 118 miles, made at an average speed of 39 miles an hour. Since then a dozen men have beaten this record, and one has flown 250 miles in five hours, with a type of machine that has traveled at 74 miles an hour for shorter distances. And at least 300 men have flown over an hour.

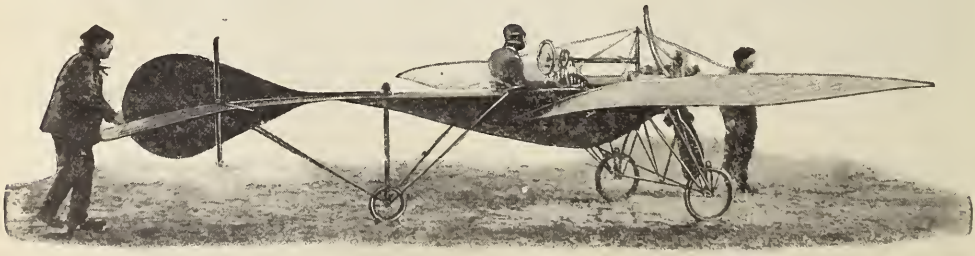
Gnome-Bleriot Carrying Three Passengers

To sum up, so great has been the progress that it quite taxes the imagination of the prophet who dares predict even the next step forward, but it is at least fairly safe to suggest that the next great flight which is destined fully to awaken even the most skeptical of mankind will be a crossing of the Atlantic Ocean by aeroplane.

How close to realization such a flight really is, is perhaps appreciated only by the very few engineers who are most closely in touch with the present status of aeroplane development.

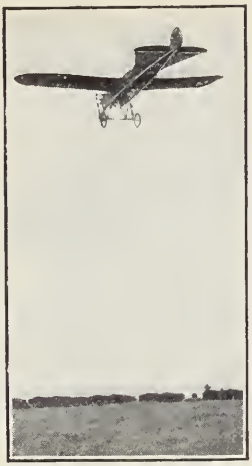
To bring more lucidly to the lay reader's mind the true measure of the suggested project, a few figures will be necessary.

To begin with, it probably will help visualize the idea to regard such a flight not so much as a matter of distance as it is a matter of time. The speed of even the fastest water craft being comparatively slow as measured against either land or aerial vehicles, the generality of mankind has the men-



Tiny Monoplane with which Moissant Flew from Paris to Within a Few Miles of London. The Span of this Machine is Only 20 Inches, its Weight with Operator, in the Neighborhood of 500 Pounds, and it is Propelled by a 50-Horsepower Gnome Motor

tal habit of regarding a five-day crossing of the Atlantic Ocean as something phenomenally fast. But when it is realized that from St. Johns, Newfoundland, to Valencia Cape, Ireland, is a distance of less than 1,800 miles, and that 50 miles an hour already has become a common average speed for aeroplanes—with the likelihood that average speeds of 60 to 100 miles an hour will be easily maintained within the next year or so—immediately a new aspect is placed upon the situation.

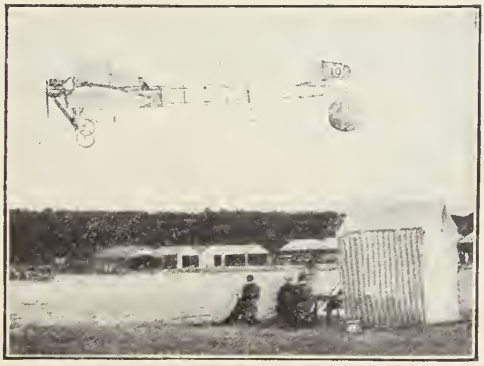


New Type Bleriot Monoplane, Which, Fitted with a Gnome Motor, Has Flown at a Speed of 74 Miles per Hour.

Incidentally it is to be remarked that from Cape Verde, Africa, to Cape St. Rogue, South America, is also a distance of about 1,800 miles, and that these two possible lines of travel for the transatlantic airship are only about half the length of the routes commonly taken by steamers. It also is to be remarked that, unlike land vehicles, the maximum speed of air craft like those of water craft are their average speeds, the unending uniformity of the aerial and the liquid oceans being in sharp contrast to the varying topography of the solid ground, which even with the best roads and railroads holds down the average speed of land vehicles despite the wonderful spurts that have been made for short distances on perfect highways, specially routed. Hence, with the quite evidently available speed of 60 miles or more an hour, it is clear that a crossing of the Atlantic, involving a flight of only 1,800 miles, if made under favorable conditions can demand only from 18 to 30 hours' continued operation of the motor. With a favoring wind—and at certain times of the year the trade winds blow very reliably and with great uniformity from East to West—it is quite possible that some 40 miles an hour at least could be added to the speed of the vehicle, which would thus reduce the time to from 13 to 18 hours—a period short enough for a single operator of ordinary physical endurance to stand the strain without relief, though perhaps two operators would be a more practical proposition.

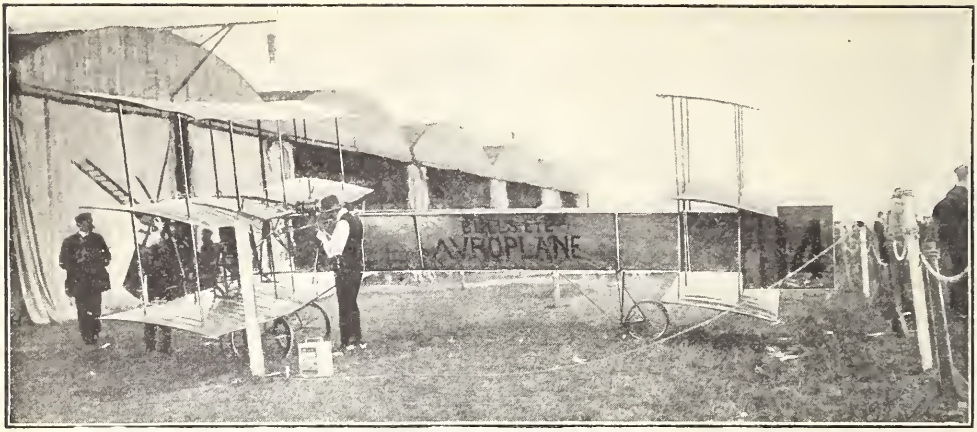
Olieslaegers in the "Bleriot," with Which He Holds the World's Distance and Duration Record for Single Flight—243 Miles in Five Hours, Four Minutes.

A point has been made so far, of premising all of the foregoing substantially upon the prospects of present-day machines, and such future development as is unquestionably to come will further simplify the problem.



Tellier Monoplane in Flight. This Machine, Which Resembles the "Bleriot," is Driven by a Panhard Motor, Consuming .6 Pt. Gasoline per Hp. Hour.

The interrelated questions of fuel capacity and of flying radius without a descent for fuel supplies can be best disposed of by a consideration of these factors in machines already built and flown. For example—to prem-



Roe Triplane, which Has Flown with as Little as Eight or Nine Horsepower, Requiring a Lift of Fully 75 Pounds to the Horsepower

ise a sort of hypothetical composite of these—it is to be noted that the Roe triplane of England lifts 75 lb. per horsepower; that the Panhard motors used in the Tellier monoplane consume only .6 pint of gasoline per horsepower per hour; that the reserve capacity of the Sommer and Breguet four-passenger biplanes is in the neighborhood of 400 lb. in addition to the weight of the machine and operator; and that the speed of the 100-hp. Gnome-Bleriot monoplane is 74 miles an hour.

That we are on the road to great improvement in the way of aeroplane efficiencies is not to be doubted, inasmuch as the birds carry at higher speeds tremendously greater weights in proportion to their power than is as yet carried by the man-built machines. Probably by the application of the more deeply curved wing surfaces of the birds—a type now known to have the greatest lifting values, but the correct and safe use of which is so little understood by even the most successful aeroplane builders that most present development is in the direction of flatter surfaces—there is every likelihood that present speeds and sustentions will be maintained with decreasing power. This helps in two ways. In the first place, less power means a lighter engine, permitting the addition of a few pounds for what is at present a much-needed increase in reliability—such, for example, as the reasonable assurance that an engine will run without attention as long as it is supplied with fuel and oil. Besides this, such weight as may be shaved off the power plant constitutes an additional reserve capacity for carrying fuel, while the less power developed involves a lower rate of fuel consumption.

Let it be assumed, then, that a machine weighing 600 lb. (approximately the weight of the four-passenger Sommer and Breguet biplanes) can be built possessing the ability to carry 400 lb. in addition to the weight of itself and one operator, and with only 16 hp. can fly as fast as the Gnome-Bleriot requiring a lift of 75 lb. per horsepower, as in the case of the previously mentioned Roe triplane. With the same efficiency as that of the Panhard motors, at .6 pint of fuel per horsepower per hour this motor will require only 9.6 pints to run it for an hour. This amount of fuel weighing about 13 lb., the reserve capacity of 400 lb. would allow enough fuel to run the motor for 30 hours—quite long enough to cross the Atlantic on the face of the figures already given, even if somewhat less than the maximum speed that appears possible is maintained.

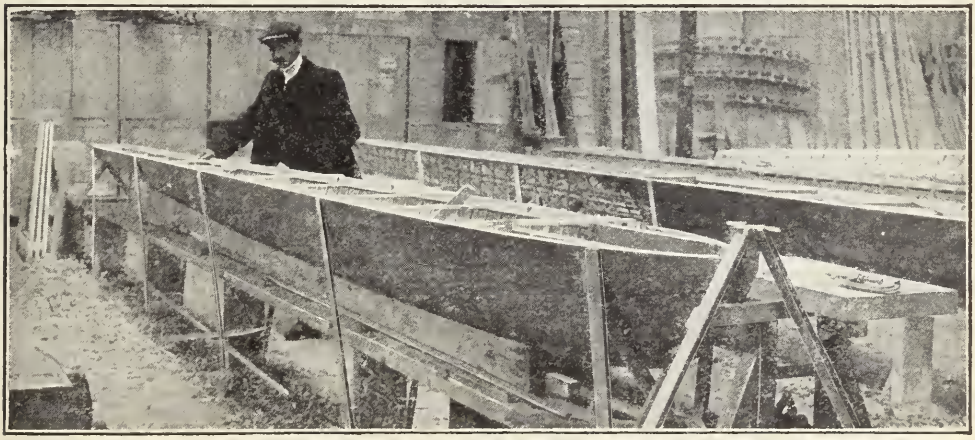
The amount of oil required may range from as little as one-twentieth to as much as one-half the fuel consumed, but as the lower figure is more probable with good engines, this is not a very serious consideration.

In the matter of water cooling versus air cooling, the much greater weight of the former, as well as the excellent results that have been secured with air-cooled motors, seem wholly to condemn the former, in so far as any really important future development is concerned.

The several factors that have not been specially regarded in this consideration so far are rather more likely to develop favorably than unfavorably. The possibility of taking advantage of the trade winds has been mentioned, but the possibility that vastly greater additional speeds may be gained in this way is one that, while not capable of proof, is quite possibly existent. In the course of kite-flying experiments, enormously high and remarkably steady wind velocities have been determined to exist in the attenuated atmosphere at great altitudes, kites flown three miles high having recorded winds blowing at velocities as great as 225 miles an hour. At such a height, the atmosphere weighs fully five-eighths what it weighs at sea level, so the loss in sustention is not too serious to be overcome with machines of sufficient area, while the lower resistance of this lighter air might facilitate enough greater speed to make up for the loss in sustention.

Who, then, can say that some Columbus of the air, who within the next couple of years will accomplish this prodigious feat of flying, may not jockey his craft into one of these intercontinental air currents far above the earth's surface, and add to the velocity of a vastly improved machine an atmospheric drift that may make the greatest speeds of travel now known seem by comparison mere crawling.

So far it has been assumed that the flight must be made without stop, a basis upon which a most absolute engine reliability and efficiency, with a reserve capacity to carry a great quantity of fuel, will be demanded. But even at this there still remains the fact that men already have flown for five hours uninterruptedly with the best present-day aviation motors, with never a missed explosion. Another way of appraising the required reliability is to consider the required number of engine revolutions. Modern aerial propellers averaging 5 ft. of advance through the air for each revolution of the engine crankshaft upon which they are commonly mounted, a distance of 1,800 miles requires 1,800,000 revolutions of such a propeller for its accomplishment. There are many automobile motors, even of fairly light weight, which have proved quite capable of running 10,000,000 revolutions without adjustment and even without stopping, if proper care is taken of the fuel and oil supplies.



Boat-Like Frames of the Hanriot Monoplane, Suggesting the Ease with Which Aeroplanes Can Be Built to Land Upon and Float On the Water for an Indefinite Period

The idea of plural engines or plural propellers is a possible road to improved reliability, though the latter seems less necessary than the former.

The necessity for a non-stop flight, however, seems materially less than it did appear until recently, for it is a new feature of aeroplane development that a machine has been built by Fabre, one of the less well-known French engineers working on the problem, which has repeatedly proved its ability to start from or land upon any fairly calm water surface—floats in the form of miniature hydroplane boats being substituted for the usual running or alighting gear. Another way of eliminating the necessity for a non-stop flight might be found in the provision of a series of boat patrols, which might serve as means of restarting the aeroplane. If 34 boats, probably on the order of the common lightships used along rough and stormy coasts, were strung out along the course, the distance from each of these to the next, about 50 miles, would enable the aviator to keep one or another in sight all the way, which would be of great advantage in that it would enable him to keep to a course that would be hard to determine by means of a compass—which though it shows the different directions, does not constitute a means of allowing for such lateral drift as might easily take place through an angular movement of the mass of the atmosphere quite unknown to the aeroplane pilot, who feels no wind but that due to the progress of his machine through the air.

The time to select for an attempt at a transatlantic aeroplane record probably would be late in August or in September, when moonlight nights could be added to days of 18 hours' duration (if the Northern route were selected).

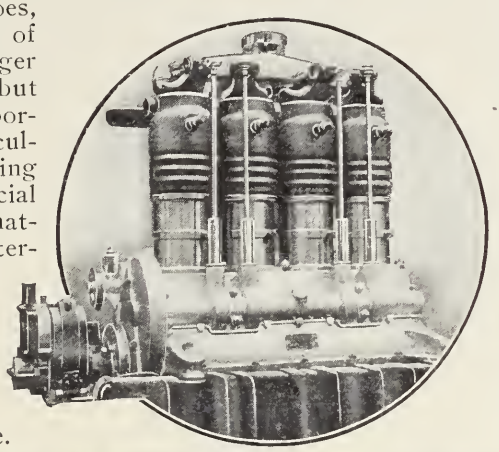
The danger is far less than might be imagined. If desired, such is the uniformity of water surface, the entire flight might be accomplished at a height not to exceed 10 or 20 ft. from the water, and thus a landing upon the water would involve no immediate fatality, since if the machine were specially built for the purpose, it could be easily made to constitute an excellent raft, upon which a hardy individual could exist for days while waiting to be picked up. Hubert Latham's first descent into the English channel, from which he was picked up by a torpedo boat without even having his feet wet, is significant in this connection. It is even well within the possibilities of early development that a deliberate descent might be made upon the water at intervals and, after refilling of the tank, the aeroplane relaunched for a further lap of the journey from the flat forward deck of a specially prepared vessel, capable of running into the wind at fair speed or else provided with a spring or weight starting device analogous to that formerly used for getting the Wright aeroplanes under way. Of course, it is to be remembered that all modern aeroplanes constitute safe and controllable gliders from any height, with motors stopped.

In any event, it is safe to assume that the pioneer who first attempts to cross the Atlantic by aeroplane may depend upon it that the navies of nearly all the nations of the earth will patrol the waters in a search for him in the case of mishap—a prospect that must prove far more encouraging than any that presents itself to the ordinary shipwrecked mariner.

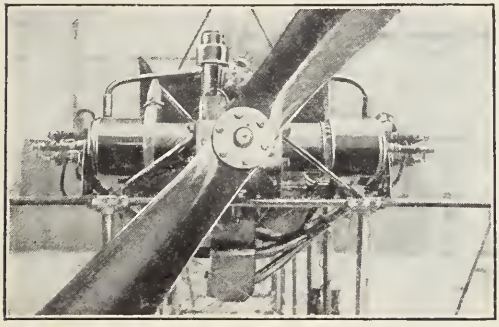
The question of the number of passengers in the initial flight is an important one. From some standpoints two must be evidently better than one, since this would mean alternation at the controls, the possible ability to give a certain amount of attention to the motor, and in every way a far less taxing strain upon the operator. But the question of fuel capacity may have to be considered above everything else, and the ability to carry an extra 16 or 20 gal. of gasoline might have to take precedence over all else.

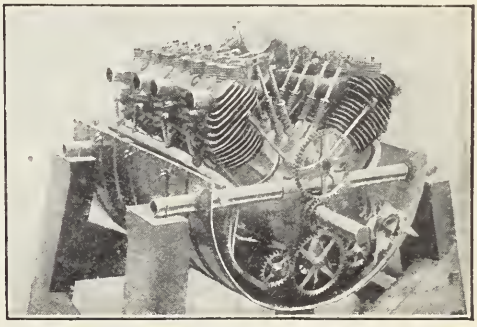
The value of such a flight to the world is beyond computation. At first certain to be regarded as no more than a wonderful stunt, accomplished by some death-defying daredevil who has the courage to place his life in the bal-

ance against honors and rewards, the ultimate result must be that from the inevitable repetitions of the flight a great commercial utility must grow. It is quite likely that this utility may not soon, if it ever does, assume the form of regular passenger transportation, but think of the importance—the incalculable value—of being able to whirl special classes of mail matter at frequent intervals from one continent to the other in a period of hours instead of days, even if nothing further were done.



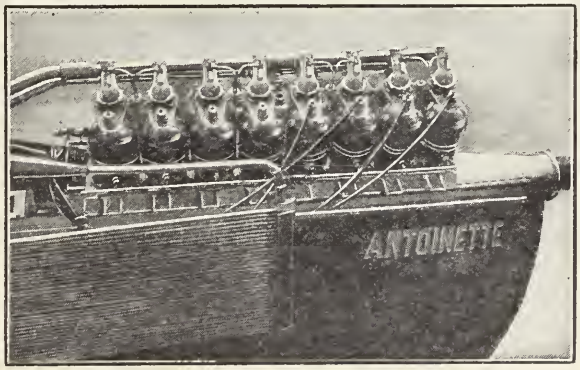
sive, but very seaworthy patrol steamers would be the first essential to maintain, stationed at close and regular intervals from one shore to the other. All that would needs be added to these would be a small fleet of aeroplanes—anywhere from a dozen to a hundred—which could be dispatched at regular intervals in both directions. With developments in wireless telegraphy, it might easily prove possible to maintain constant communication between the aeroplanes and the patrol boats, and thus all the way from land to land, and the only recurring type of accident likely would be the decreasingly frequent involuntary descents upon the water compelled by engine failure. These would be quickly discovered by the passing of one patrol boat by the aeroplane and its failure to





The equipment necessary for the maintenance of such a service will be any number of times less expensive than is required by the transatlantic steamship companies, or even by the cable companies.

Probably a series of small, slow and inexpen-



A GROUP OF EUROPEAN AVIATION MOTORS

Upper View—A Panhard Motor Used on the Tellier Machines; Left-Hand View—Horizontal Opposed Darracq Motor, Developing 25-30 Horsepower, Weighing Only 66 Pounds, with Which Some of the Most Successful Santos-Dumont Machines Were Equipped; Right-Hand View—An Eight-Cylinder, V-Shaped Fiat Aviation Motor, 50 Horsepower Developed with 110 Pounds' Weight; Lower View—A 16-Cylinder 100-Horsepower, V-Shaped Motor That Was Fitted to Some of the Antoinette Monoplanes.

appear on schedule at the next. Then another aeroplane or two could be sent out to circle around until their foundered fellow were located, whereupon the nearest patrol boat would be called to pick it up. Even should it prove impracticable to maintain such a service regularly during the colder and more stormy seasons of the year, the extent to which it could be maintained would still afford a great, and once civilization had become habituated to it, an indispensable utility.

It is easy to apprehend the many objections that can be made to this anticipation of the future, in which only a very few may have any serious faith at the present time, but it is the lesson of mechanical history that the ignorance of the many, and their ridicule of what they are unable to understand, never for a moment retards progress. Eighty years ago the railroad train—60 years ago the steamboat—30 years ago the bicycle—15 years ago the automobile—were jokes in the eyes of the multitude. Now they are common conveniences of civilization, availed of by every one. Today it is the aeroplane that is the jest of the prosaic minds that vegetate through life while contributing nothing to the sum of human progress. Tomorrow it will be this same wonderful ship of the skies, which now stirs the enthusiasms of the farseeing few only, that will take its settled place in the scheme of things—another contribution from the genius of the race to the masses of mankind. Thus does history unfailingly repeat itself.

PARIS PREPARING FOR FUTURE FLOODS

The havoc caused in Paris during the early part of this year by floods resulted in the appointment of a commission to investigate and adopt measures to prevent a recurrence of the disaster. The report of this commission, the engineering plans of which will probably be carried out to the letter, provides for the widening of the smaller arm of the Seine above the bridge St. Michel, the reconstruction of the Archeveche, Double and Petit bridges, the displacement of the Orleans railway near the bridge St. Michel, the modification or suppression of the Monnaie dam and lock, the raising of the embankment walls 20 in. above the highest water level during the flood, and the adoption of suitable means for hermetically closing the openings into the Seine when a rise in the water level threatens.

The sewers discharging into the Seine are to be fitted with sluice gates, which may be opened or closed from above. An additional collector and siphon under the Seine to receive the waters from Javel and Grenelle is also proposed.

Besides widening the smaller arm of the Seine, it is proposed to deepen the bed of the river between Suresnes and Bougival, at a cost of $6,000,000, and to construct a canal from Annette, on the River Marne, to Epinay on the Seine, at an approximate cost of $35,000,000. This would pass much of the water of the Marne around Paris, thus relieving the Seine of it, until after the latter had passed through the city.

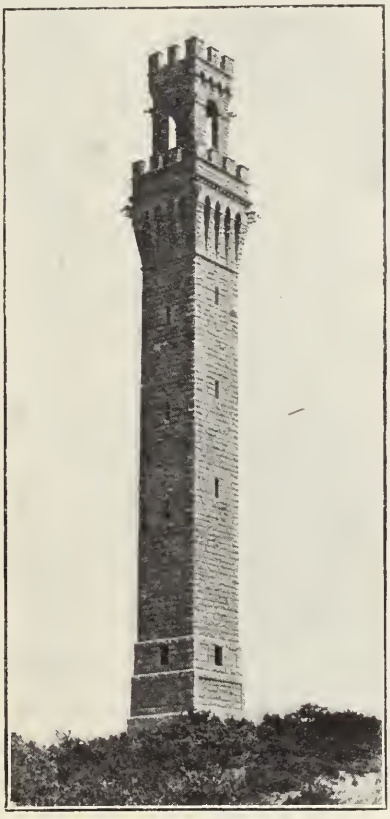
BLIND PERSONS TO USE WHISTLES

The danger to which the blind or partially blind are exposed in crossing the crowded thoroughfares of large cities, has caused an association for the benefit of those so afflicted to seek permission for the blind to use whistles.

Such a petition has been presented to the chief of the Chicago police department and granted, with the understanding that the tone of the whistles, not to be confused with the shrill blasts of those used by crossing policemen, should be soft and mellow. The crossing police have been instructed to pay special attention to the signals of the blind and to help them across the streets.

THE NEW PILGRIM MONUMENT

The new Pilgrim Monument on Cape Cod, which was dedicated by President Taft in August, is attracting international attention as an engineering marvel. Although the monument is 252 ft. in height and weighs 7,250 tons, ranking next to the Washington National Monument as the loftiest structure of solid masonry on this continent, it has been set upon a hill of sand and that, too, with what the uninitiated might regard as a conspicuously inadequate foundation. Yet for all its location on the sand dunes at one of the most exposed points on the Atlantic coast, it shows no vibration in the strongest gales that sweep over the extremity of Cape Cod, tests having been made when the velocity of the wind was in excess of 84 miles an hour.



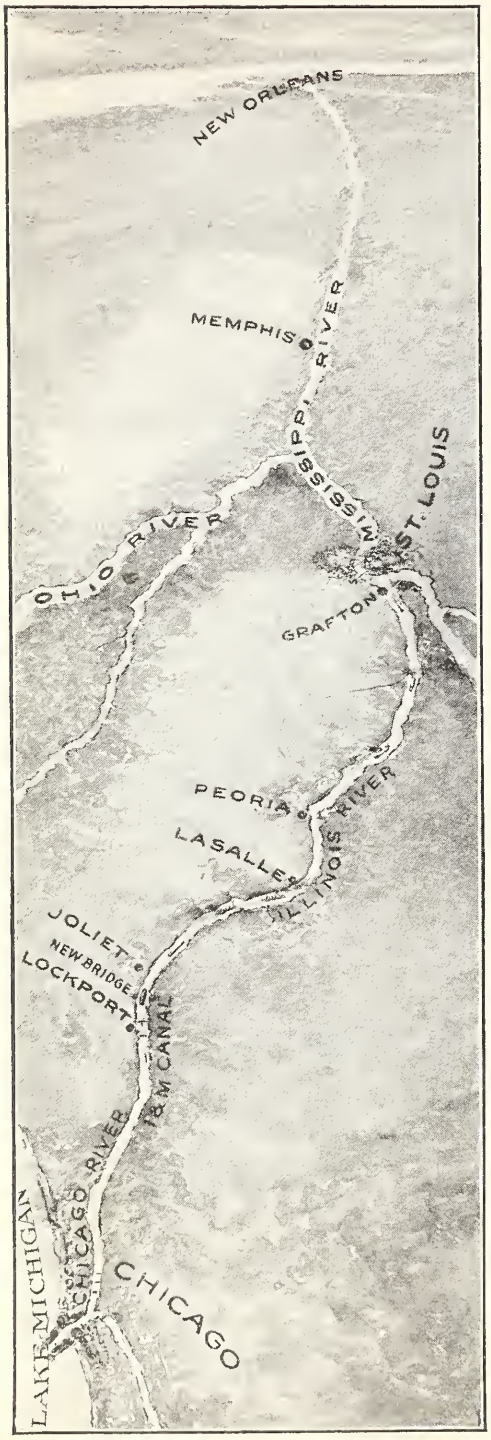
Ranks Next to the Washington Monument as Loftiest Structure of Solid Masonry

This great granite tower, which has cost upward of $100,000, has been under construction for nearly three years, President Roosevelt having laid the cornerstone, and the cost was defrayed by the national government, the state of Massachusetts, and private subscription. The government engineers gave much thought and study to the problem of anchoring such a monument on top of a hill of sand rising 90 ft. above mean low tide. It was finally decided to make no deep borings for concrete piers. Instead a square excavation was made to a depth of 10 ft. and on the level floor of pure, hard sand, a layer of wet concrete was placed to a depth of 3 ft. This constituted the first section of the monument foundation.

On top of this came a strata of reinforced concrete, embodying six different layers of steel rods, each rod an inch square. The rods crossed each other at right angles; at the corners rods were placed diagonally 5 in. apart; and each layer was keyed to the layer below. The ultimate reinforced block represented hundreds of the steel rods and 1,600 tons of concrete. This portion of the foundation is 50 ft. square at the bottom and 28 ft. square at the top, being pyramidal in form.

The masonry tower which rests upon this concrete foundation is 27 ft. square at the base, allowing a margin of 6 in. of foundation outside the base line on all four sides. The masonry structure is "anchored" to the foundation by means of steel rods and these steel rods, in comparatively short lengths but overlapping one another, extend to the top of the monument, having been embedded in concrete between the outer and inner surfaces of the masonry as the work progressed.

Upon the completion of the monument, the government engineers conducted tests and found that it had settled only one-quarter of an inch, and moreover the depression had been uniform at all points, so that the structure does not vary a hair's breadth from the perpendicular. The interior of the monument is 17 ft. square. Ascent is



The "Lakes to the Gulf"—Birdseye View from Chicago

accomplished through the instrumentality of combination inclined plane and step systems, constructed from reinforced concrete, and which enable sightseers to gain access to an observation platform under the arch at the top of the platform and 201 ft. above the base.

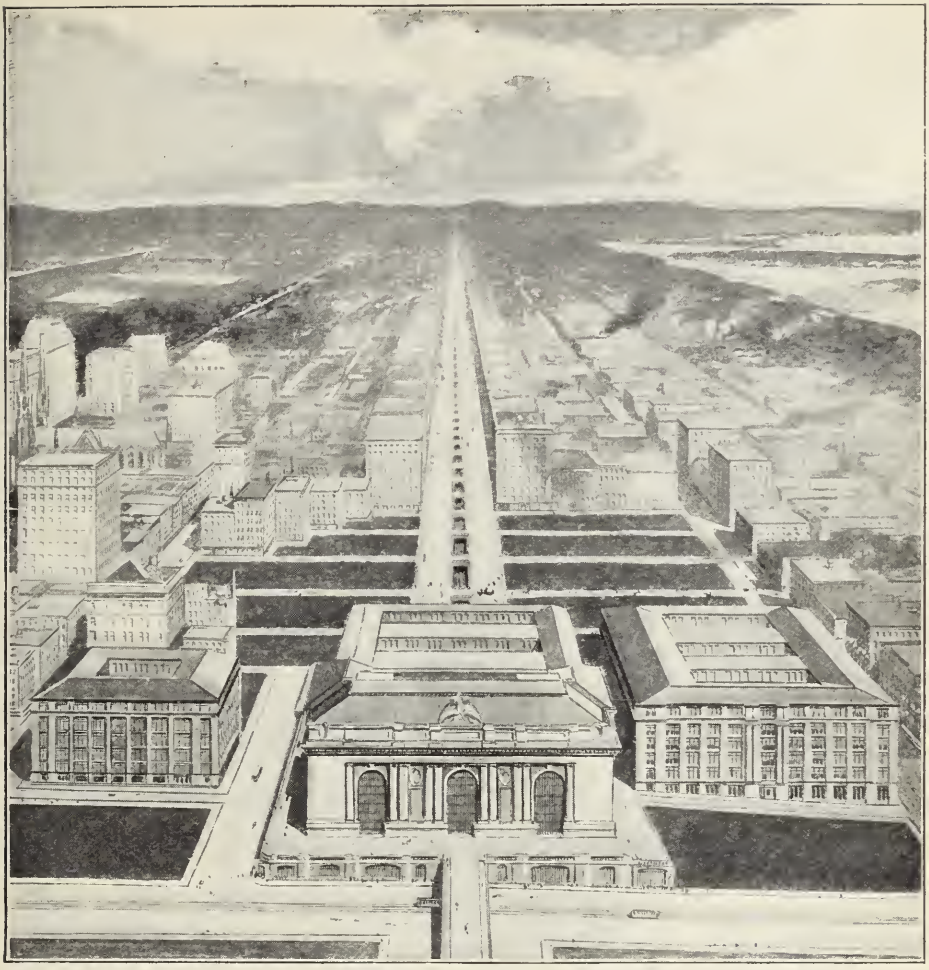
WATER TRANSPORTATION BETWEEN CHICAGO AND THE MISSISSIPPI

The blowing out of an obstructing bridge below Lockport, and the removal of a towpath bridge in Joliet, has opened a barge waterway from Chicago to the junction of the old Illinois and Michigan canal with the Illinois River at La Salle. Below La Salle the Illinois River is navigable to the Mississippi for big river steamboats, which means that water transportation from the lakes to the gulf is now a fact.

The obstacle to water commerce between Chicago and the river ports has been the upper stretch of the Illinois and Michigan canal, between Chicago and Joliet, which is now eliminated by the Chicago drainage canal. The lower stretch of the Illinois and Michigan canal is much better, and will allow the passage of barges of 200 tons' capacity. The Mississippi River steamboats will navigate the Illinois River to La Salle, where their freight will be transferred to barges for Chicago.

"All that is now needed to have a deep waterway from the Mississippi to Chicago," says Isham Randolph, consulting engineer of the Chicago sanitary district, "is the opening up of the Illinois and Desplaines Rivers and making them navigable between La Salle and Joliet. The Illinois and Michigan canal need not be used at all when this is accomplished, and the river steamboats may steam right into the heart of Chicago."

¶Spain proposes to build a continuous highway, 1,674 miles long, through that kingdom for the purpose of attracting motor tourists.



Birdseye View of Proposed Terminal—Vacant Blocks to the North to be Occupied by Monumental Buildings

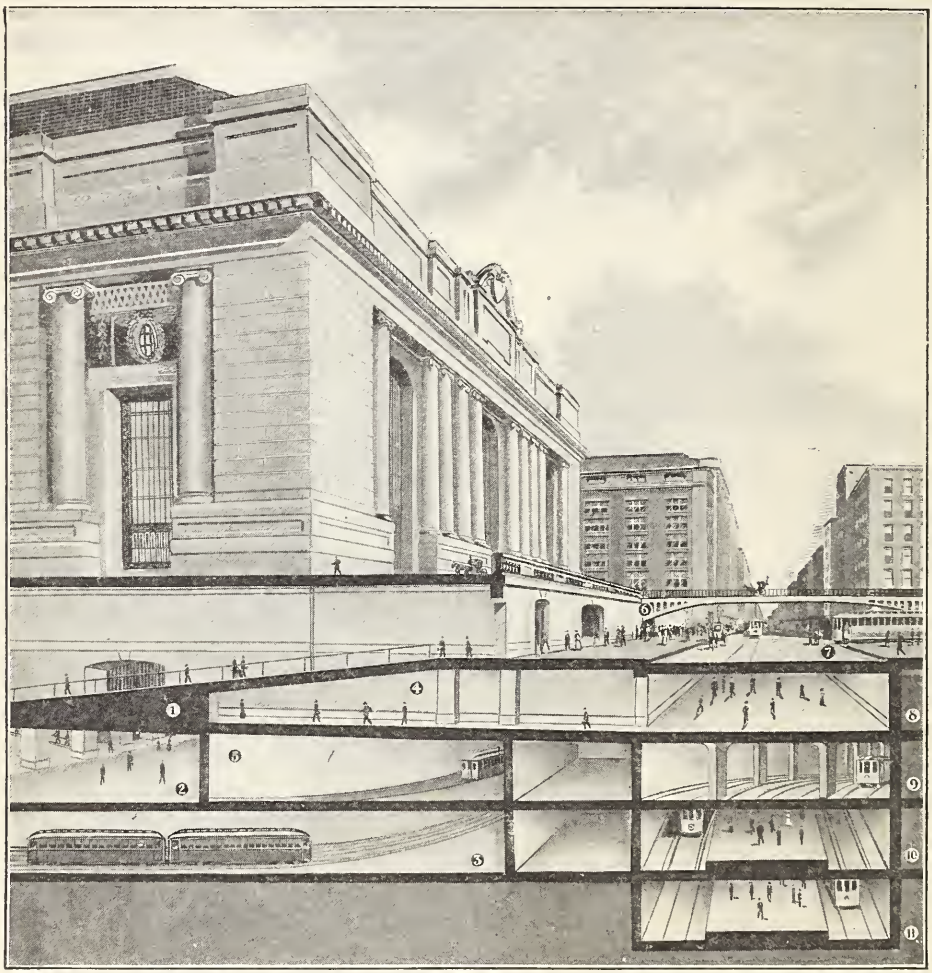
GREATEST RAILROAD TERMINAL IN WORLD

Railroad passenger terminals, like transatlantic liners, are growing to stupendous size. The great railroad station, heralded yesterday as the largest and most wonderful in the world, is dwarfed by the one of today, and this in its turn by the great terminal projected for tomorrow.

Just as the Pennsylvania system was ready to announce the completion of its $100,000,000 terminal, with its maze of tunnels and subways, the New York Central made known its plans for a terminal in the heart of New York, at an estimated cost of $180,000,000 and twice as large as any in existence. Instead of the tunnels of the Pennsylvania station, it will have a vast channel, two city blocks wide, and 10 blocks, or half a mile, in length, cut out of the solid rock. The work on this channel, carried on with the most perfect blasting and drilling apparatus, is just being completed after several years of incessant labor.

On each side of this man-made

chasm, and in some places directly over it, will be buildings that will form one of the most imposing groups of structures in the world. The buildings along Park Avenue will be of a monumental character, and the station building proper, spoken of as the "head house," will have a wide plaza in front of the main passenger entrance. Altogether the project will cover 20 city blocks, and over the 70 acres of tracks in the chasm, roofed level with the streets, will rise magnificent buildings. Some of these structures will be used for station purposes, others rented to manufacturers and wholesale merchants for the display of their wares, while still others will be reserved for fine arts exhibitions. In fact, without this provision for vast rental space the $180,000,000 investment would not have been justifiable.



Subways at New Grand Central Station—1, Incline to Through Train Concourse—2, Suburban Train Concourse—3, Suburban Train Loop—4, Passage to Through Train Concourse—5, Express Train Loop—6, Bridge over Street—7, Street Level—8, Joint Concourse for All Subways—9, Interborough Subway, West Side, Bronx, Brooklyn—10, McAdoo Tube to New Jersey—11, Belmont Tube to Long Island.

The waiting rooms and concourses for the passengers will occupy a total

of more than six and one-half acres, calculated to accommodate nearly 30,000 persons. The great concourse for the outbound passengers will hold 15,000 passengers comfortably, and the inbound concourse 8,000, while the waiting rooms proper will hold more than 5,000 more. The outbound capacity will be 70,000 passengers an hour, which is double the maximum carrying power of any passenger station in the world. Some 200 trains can be sent out every hour if necessary. Owing to the unique arrangement of the tracks, it is possible to keep practically one continuous train in motion. Instead of backing out after having discharged their passengers, as is ordinarily done, the trains will continue on around a loop.

Last year 21,000,000 passengers passed in and out of the Grand Central station, and the new terminal arrangement will accommodate more than five times as many, more, indeed, than the whole population of the United States.

The new terminal will have four levels, or three more than the old. The gallery on the grade of 42nd Street will be the top level. The next will hold the concourse and 42 tracks for through trains and will connect with the subway lines. On the third level will be 25 tracks for suburban trains, and under this a subway for inbound and outbound baggage.

The arrangements for the comfort of passengers show many innovations. One feature, for instance, is the little dressing-rooms, to be rented for a nominal sum, in which passengers may remove the marks of travel and change their clothes.

Another important and unique feature of the construction is the elimination of stairways. Wherever it is possible, gently sloping inclines take the place of steps. It is said that no railroad station in the world can be reached so quickly and in so many different ways for a 5-cent fare.

REMAINS OF A JAPANESE SENT HOME BY MAIL

The shipping, through the mails, of the remains of a deceased person seems extraordinary, yet the Postoffice Department was recently called upon for such service, and, finding nothing in the law to forbid it, complied.

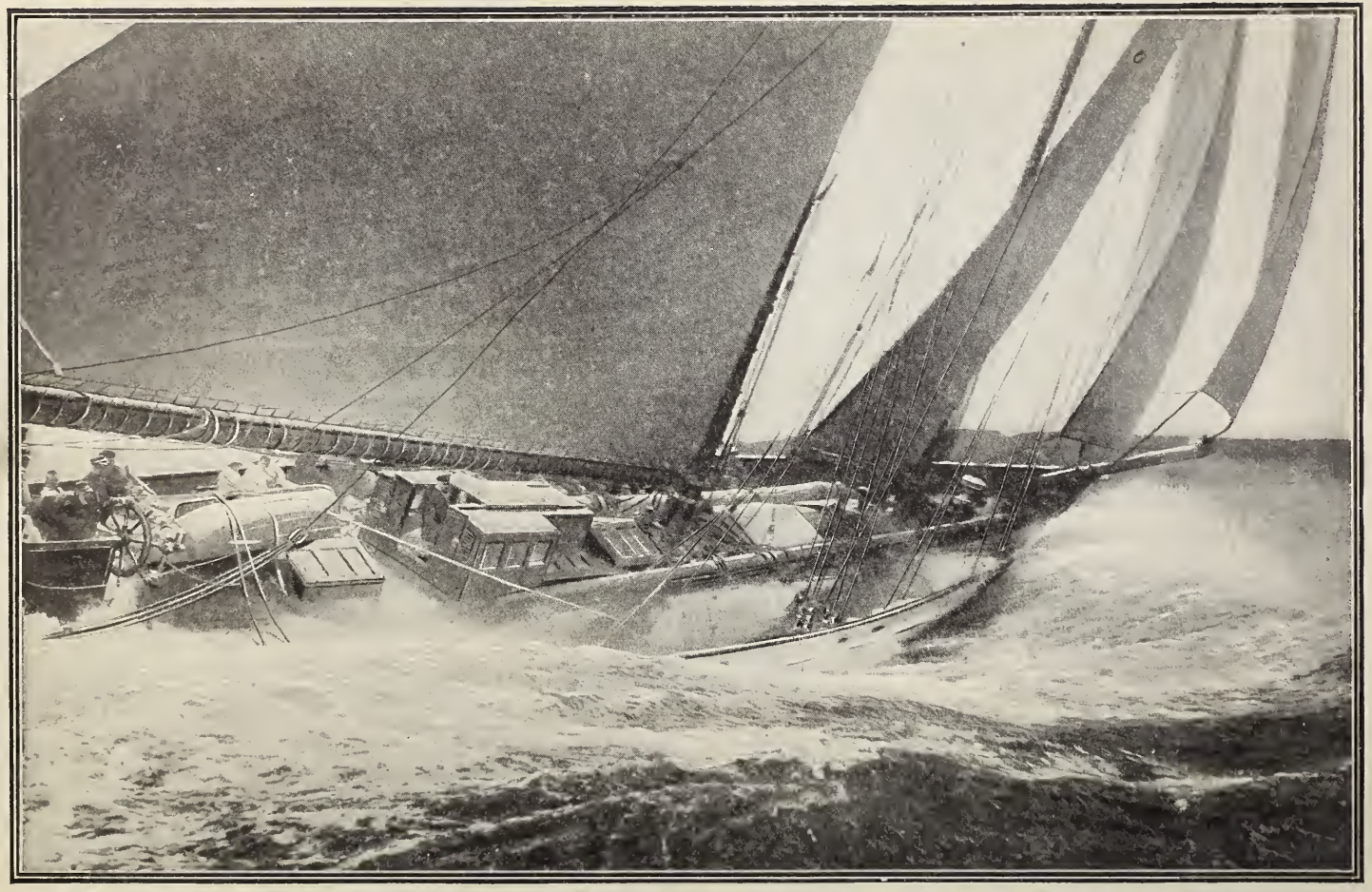
The remains were those of a Japanese boy who had lived in Denver. His father, wishing him to rest in the fatherland, had the body cremated and the ashes tightly packed in a hermetically sealed jar. The postage required from Denver to Japan was only 22 cents.

A NEW DRINKING FOUNTAIN

While the managements of public institutions are making rapid progress in securing sanitary conditions, the average person is looking forward to having the same benefits in his own home. The ever-flowing drinking fountain in public school buildings makes a germ-proof method of obtaining water without the aid of a glass or tin cup. Practically the same sanitary drinking fountain has made its appearance in a device that may be attached to any water pipe connection for use in

For Home Use

homes as well as large and small school buildings. This simple fountain, as shown in the illustration, has a few points of superiority, one of which is the glass over-flowing cup. When the water is turned off for the night or at times when there is no use for it, the pipe and cup are completely drained through small holes provided for that purpose. The valve is set to make the overflow right on the water pressure.



Remarkable Photograph Taken During the Royal Yacht Club Races in August—The Deck of the "Cicely" (Schooner) Under Water

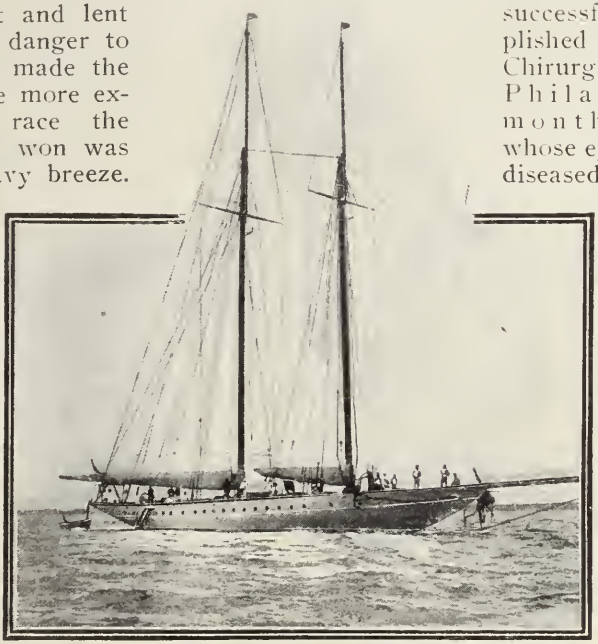
AMERICAN YACHT WINS IN ENGLISH RACES

An American-built yacht, the "Westward," won the Royal Yacht Club prize from Sir Thomas Lipton's "Shamrock," at Cowes, on August 1st. The racing over the famous English course this year was attended by more than ordinary difficulties and called forth the utmost skill on the part of the yacht commanders. Choppy seas and stiff gales caused more or less discomfort and lent an element of danger to the sport that made the contests all the more exciting. The race the American boat won was sailed in a heavy breeze. The Kaiser's American-built yacht "Meteor" finished fourth in this race, with the "Germania" third.

The "Westward" is owned by Mr. Alexander Cochrane and this is her first season.

"Cowes Week" was made notable this year by the presence of King Alfonso, who took advantage of his visit with Queen Ena to her English relatives to look over the yachts of the Royal squadron. Alfonso is a keen sportsman himself and is an expert skipper. He spends much time on his racing yachts while at San Sebastian. While he was a guest on Sir Thomas Lipton's yacht, the "Shamrock," she was almost wrecked by the falling of her topmast. The topmast was 50 ft. long and fell to the deck.

The racing was also given a place out of the ordinary by the sailing of the first race for the King's Cup, presented by King George V. The cup was won by Lord Dunraven's yacht, "Cariad II," a 150-ft. ketch.



The "Westward," Which Won from Sir Thomas Lipton's "Shamrock" at the Cowes Races

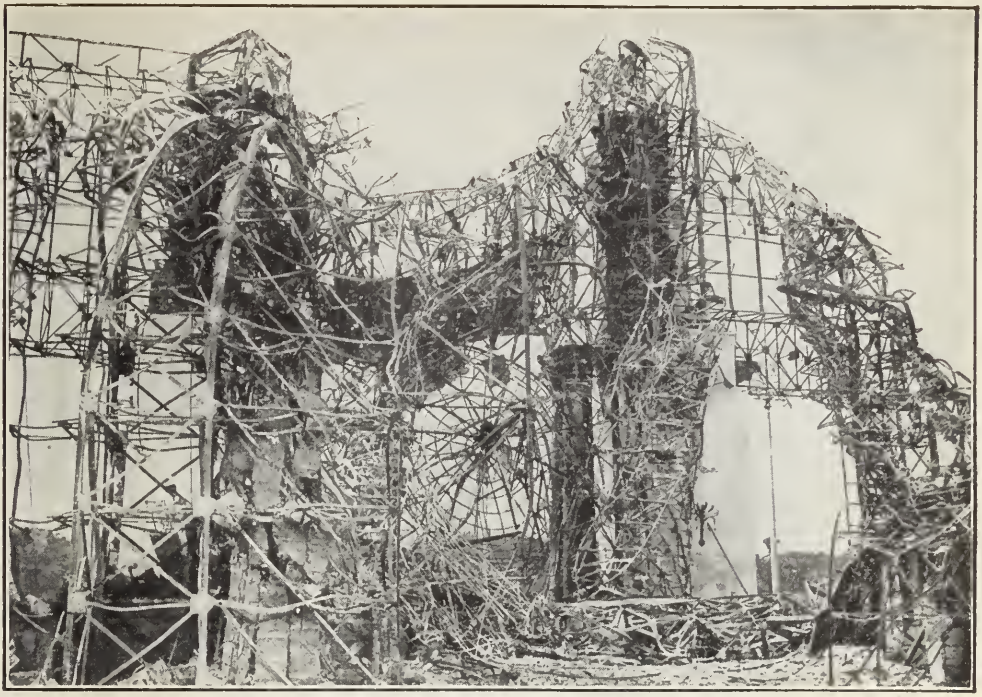
CORNEA GRAFTED ON EYE RESTORES SIGHT

The grafting of a healthy cornea to the eye of a person who had been blind two years, as a means of restoring sight, was successfully accomplished at the Medico-Chirurgical hospital in Philadelphia last month. A woman whose eye was so badly diseased that she had become blind was the subject of the operation. A workman in the Baldwin Locomotive Works was struck with a minute steel filing which penetrated the cornea and the muscles of the eyeball, completely destroying the usefulness of the latter. The woman was an inmate of the hospital and as an experiment the surgeons took the healthy cornea from the injured man's eye and grafted it on the eyeball of the woman. When the wounds healed, the eye was found to be in almost as good condition as though nothing had happened to it and the woman could see.

¶The first man of record to become insane on the subject of aviation has appeared in New York. He imagines himself the brother of the Emperor of China and thinks he has perfected the art of flying.

A REMARKABLE PHOTOGRAPH OF THE FIRE AT THE BELGIAN EXPOSITION

At the Extreme Left: the Restaurant "Chien Vert" (Green Dog). Next the Triumphal Arch Surmounted by a Statue of St. Michael at the Entrance to the Exposition. In the center the Blazing Ruins of the Administration Buildings Are Seen, and at the Right, the Tangled Iron Framework of the Central Palace of the Belgian Section.



Scene in the Belgian Section After the Fire

Showing the Complete Devastation in the Burned District

MASSES of twisted steel and crumbled plaster were all that was left of many of the handsome buildings at the international exposition at Brussels, Belgium, after it had been swept by fire on August 14. The buildings as a whole were composed of a light steel framework clothed, as is customary with temporary exhibition buildings, with lath and plaster. Such buildings burn like tinder. Varying estimates on the damage place it between twenty and fifty million dollars. but on account of the destruction of many priceless art treasures, the loss cannot be entirely figured in money.

MINING IN THE PHILIPPINES

There are at the present time in the Philippines two gold districts producing results, while much exploration is being carried on in five other localities. In Benguet there are three mills in operation, with prospects of three others in the near future. Three dredges are working night and day and yielding substantial returns in Ambos Camarines, and mills are about to be erected on the San Mauricio and Tumbaga.

Hand-Boring Tests for Gold

Other ore prospects now being developed in the islands include copper, lead and iron, while coal and oil promise well for the future. Development work is steadily progressing on the copper deposits of Mancayan-Suyoc, and prospecting is being carried on in six other localities. Promising lead prospects have been explored on the island of Marinduque, and lead is also known to exist in Cebu. Iron deposits were known long before the American occupation, in Ambos Camarines and in Marinduque.

A chrome iron ore has recently been discovered in the province of Surigao, and there is one small native iron furnace at Angad, operated by Maria Fernandez, a Filipino woman, the only woman of the islands who is a mine operator. This is the only iron furnace in existence in the Philippines, and its product is almost wholly used in the making of plowshares for the natives of the neighboring provinces.

There are at present two coal mines in active operation, both situated on the little island of Batan, on the east coast of Luzon. One of these mines is operated by the United States government; the other is a private concern, supplying coal to from 20 to 25 inter-island steamships. Coal has been found on several islands in the archipelago and at least two oil fields exist.

Only Iron Furnace in the Philippines—Operated by a Woman

FINDING PEARLS WITH X-RAYS

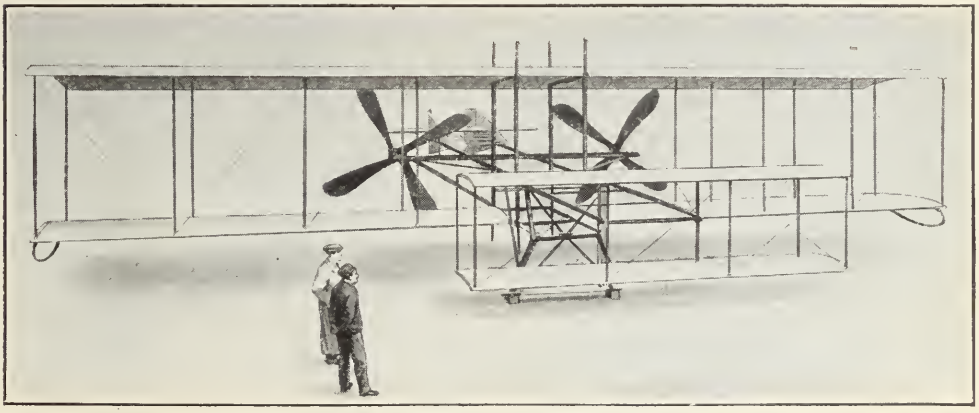
Through the utilization of the X-ray, the necessity of opening every oyster in the gathering of pearls has ceased to exist at a pearl fishery in the Ceylon Islands. The oysters are arranged in batches

of a hundred on a moving platform or carrier, and are passed in succession under the rays and above a special paper devised for direct radiography. Unless the subsequent development of the prepared paper betrays the presence of a pearl, the oyster is not opened. If the pearls discovered are small, the oysters containing them are replaced in their natural home, and are from time to time re-examined until the pearls are large enough for commercial purposes.

AN AEROPLANE BUILT TO CARRY EIGHT PASSENGERS

The largest aeroplane ever built has just been produced in private shops near Paris for the De Dion-Bouton Company, the automobile manufacturers. The aeroplane is of the biplane type with a wing spread of 65 ft., and measures 47 ft. 5 in. from front to rear extremity. The two main, superposed planes are 8 ft. 2 in. from front to rear edge, and are the same distance apart. In front is a biplane elevation rudder of such dimensions that it alone could be used as a man-carrying glider. Its length is 14 ft. 9 in., and its depth 3 ft. 3 in. It is estimated that the machine will weigh 749 lb., without motor or mechanical fittings.

Lateral stability is secured by the use of ailerons, carried midway between the two planes and projecting beyond them, as on the Curtiss machines. At the rear are two horizontal planes with variable angle of incidence, and two vertical planes, the extremities of which form lateral rudders. Hollowed American spruce, wrapped with varnished canvas, has been used exclusively for the framework. The wood is split lengthwise, hollowed out, and the two halves joined together by a special process of gluing that makes them impervious to moisture, and unaffected by heat.



The Eight-Passenger Aeroplane

The motor will be mounted on the main framework at the level of the lower plane, and just in advance of the entering edge.

Two propellers are employed. Each has four blades. They will be driven through reducing gears, giving them a speed of 400 revolutions a minute.

THE GUIDING LIGHTS OF THE OCEANS

The number of lighthouses and lightships in the world, not including the inland bodies of water, such as the Great Lakes, is 15,224. Of this number, 12,171 are on the Atlantic; 2,288 on the Pacific; 677 on the Indian Ocean, and 88, in the Polar seas.

Rangers Going to the Head of a Prairie Fire with Fire Wagon

Bull River Ranger Station

Forest Guards on Fire Patrol Duty

Forest Ranger Putting out Ground Fire With Wet Blankets

DEVASTATION OF FORESTS BY FIRE

Every year has brought its disastrous forest fires, resulting in timber loss mounting into the millions, destruction of property, and deaths. But the record this year, due to a great extent, say advocates of conservation, to the fact that Congress refused the required funds for even as much forest patrol as has previously been possible, is far more overwhelming than ever before.

Three states, Washington, Montana, and Idaho, suffered severely, great stretches of forests, including national reserves, being wiped out in each. Many communities were abandoned before the onward sweep of the flames, and many lives were lost, mostly among the forces called out to fight the fires.

According to a bulletin just issued by the Forest Service, forests fires are of three classes, surface fires, which burn the surface layer of dry leaves, grass, brush, and small trees; ground fires, which occur where the mineral soil is covered with a deep accumulation of vegetable mold; and crown fires, which burn through the crowns of the trees.

Nearly all forest fires start as surface fires, the dry litter on the ground being ignited by a spark from an engine or camp fire, or, as was charged during the recent fires, may be ignited intentionally. At first the fire burns in a small circle, gradually spreading out in all directions. If there is a wind, the fire burns with greater intensity on the leeward side, and quickly assumes an oval form. At first the front of the fire is very narrow, but gradually widens and takes the form of a broad, irregular line. The front may reach indefinite proportions, from a few hundred feet to several miles in width. Ordinarily a surface fire simply burns along the ground and does not go into the tops of the trees. Sometimes the flames reach up into the crowns and scorch them, even igniting them here and there, but such a fire is classified as a surface fire, unless it actually burns through the crowns.

The term "ground fire" is applied to the slow fires that burn in the deep accumulations of vegetable matter common in many of the damp northern forests. The fallen leaves, needles, and other offcastings of the trees decompose very slowly, and this material absorbs much moisture and retains it tenaciously. Consequently, it is very seldom ignited, but in some seasons becomes thoroughly dry and will burn. When it does ignite it burns very slowly, but with intense heat, and is very difficult to extinguish. Such fires in the Adirondacks have been known to burn all winter, creeping along under deep layers of snow.

Crown fires almost invariably start from surface fires, and occur when the woods are very dry and when there is a high wind. Without a strong wind, a crown fire is seldom started, but if the wind is sufficiently high, will spread with great rapidity, taking at once a V-shaped front with a distinct head. This front may be only from 50 to 100 ft. wide, or, in the case of large fires, may be very great, consisting of a series of heads. Close behind the fire in the crowns of the trees comes a surface fire, burning with the same rapidity. The strong draft of heated air arising from the fire carries up with it an immense quantity of burning cinders and pieces of bark. The wind carries this material far in advance of the main fire head, and thus innumerable new surface fires are started, which fact gives rise to the popular idea of a spontaneous starting of fires in advance of a crown fire.

HAND-PAINTED HATS LATEST MILLINERY FAD

Efforts have been made to interest the Audubon Societies throughout the United States in the newest phase of the crusade against the use of birds' plumage in millinery; the London style of hand-painted hats. These hats are being sold in large quantities not only to women who are opposed to the de-

struction of birds in order to get their plumes, but to many people who are inspired simply with the desire of obtaining a pretty hat. The prices charged

Hand-Painted Hat with Floral Design

for them vary with the artistic merit of the painting and the quantity of it displayed on the hat.

While most of the headgear of this type seen on the Strand or in Regent street is of light color, the scheme has been adapted to darker shades as well. It consists of painting in natural colors wreaths of flowers around the crown and on the brim of felt hats. The colors are so applied that the hats can be cleaned without damage. The buyer can secure any design that suits her taste and fancy, as most of the hats are made to order with color schemes to match the wearer's dress and meet the requirements of her complexion.

¶Old-fashioned merry-go-rounds, imported to China as an adjunct to a circus 10 years ago, never met with favor and were recently sold for junk at auction in Shanghai.

MECHANICAL CUT-OFF FOR PARLIAMENTARY BORES

First aid for bored statesmen is promised by a Japanese inventor, if the parliaments of the world will adopt the ingenious and perfectly simple device he has constructed for cutting off orators, filibusters and the like whenever the patience of the majority is taxed to the limit. According to a description given in Engineering and Contracting, the orator is made to stand on a specially prepared section of the floor which is hinged in the manner of the trapdoor on the stage. Each member's desk in the hall is connected with the lock of the trap by a tube and each member is provided with a ball made of lead or other metal that is small enough to enter the tube. When a member does not like the sentiments or style of the orator, he simply drops a ball into the tube at his side. When a number of these balls, sufficient to represent a majority of the members, is dropped into the tubes, their combined weight springs the catch on the trap and the orator is quickly dropped to the floor below.

THE FRENCH SUBMERSIBLE ACCIDENT

The overhauling of the French submersible "Pluviose," sunk by a collision with a passenger vessel in the English channel, has led to the belief that the little vessel was disabled by internal trouble before the collision occurred. Before, or at the moment of the collision, short circuits broke out all over the vessel, especially in the central post, where all the cables were found fused, the woodwork of the switchboard charred, and the ebonite twisted or broken. If the fire broke out before the collision, it could have been responsible for rendering the crew powerless to prevent the crash.

¶A broad highway, 60 miles long, suitable for motor vehicles, is contemplated to connect Toledo with Detroit.

EVENTS OF THE MONTH IN AERONAUTICS

The ambition of aviators in both Europe and America seems now to be set upon high flight. The mark set by Brookins in July was quickly surpassed by J. Armstrong Drexel, at Lanark, Eng., when he established a new world's record, 6,750 ft., on August 12. Drexel was only permitted to wear his honors a short time. On August 29, Leon Morane ascended 6,889 ft. at Havre. Glenn Curtiss announced he would go after the altitude records on the occasion of his flight from Euclid Beach, Cleveland, Ohio, to Cedar Point, near Sandusky, and return on August 31 and September 1. Owing to the stiff breeze blowing at the time he did not carry out this part of his program, although he established a record for distance flight over water, having made 120 miles over Lake Erie, 60 miles from Cleveland to Cedar Point, which he accomplished August 31, and 60 miles on the return, September 1.

Aside from the altitude records the most interesting event in aviation during the month of August was the spectacular attempt of John B. Moissant, an American, to fly from Paris to London with a passenger. Starting from Paris on August 17, he safely negotiated the better portion of his flight, but through a series of unfortunate accidents missed the goal for which he was striving, 27 miles short of the English metropolis. He carried his mechanician, who weighed 182 lb., as a passenger.

Military aeronautics have occupied the attention of all nations and many distinct advances have been noted. Maj. Samuel Reber and Lieut. Clarence C. Culver of the U. S. Signal Corps, completed a series of successful wireless experiments at Mineola, Long Island, on August 25, with the assistance of J. C. Mars, J. A. D. McCurdy and H. M. Horton, the latter being the inventor of a method of adapting the wireless apparatus for aeroplanes. No difficulty was experienced by the army officers in receiving and sending messages. Experiments with the new type

J. ARMSTRONG DREXEL,
American Aviator Who Has Made Some Remarkable Flights in England

of field guns, invented for the German army, against dirigibles were highly successful from the point of view of the gunners, the balloons being shattered during the course of the tests which were held at Ruegenwalde, Prussia, August 11. Grahame White, the English expert, made a flight around the assembled English fleet at Tor Bay early in August, dropping theoretical bombs from an elevation of 1,000 ft. The Japanese war office has closed a contract with the German representatives of the Wrights to supply the Mikado's army with a fleet of aeroplanes, and officers

are to be sent to Germany to learn to fly.

A company was formed during the month for the purpose of carrying on a regular insurance business against losses through aviation, as well as life and accident insurance for aviators, and in Arizona a mine owner closed a contract for transportation of freight to his mines by monoplane.

Walter Wellman finished preparations for his flight across the Atlantic ocean by dirigible at Atlantic City, August 29, and announced he would start within two weeks. The balloon is 220 ft. long and has two engines of 80 hp. each.

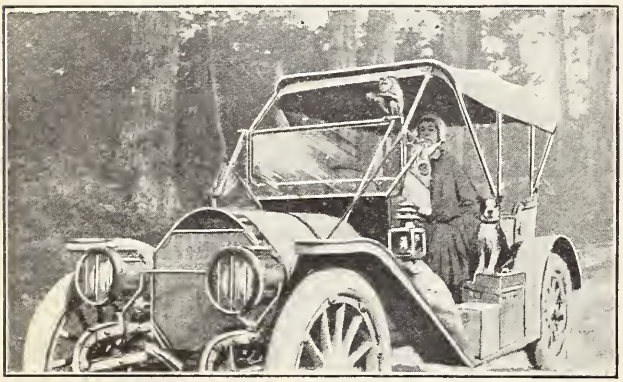
LeBlanc covered himself with glory at Paris on August 17 by winning the Le Matin prize of $20,000 in the distance cross-country flight of 489 miles, which he covered in 11 hr. 56 min. of actual flight.

One remarkable feature of aviation during the month of August is the small number of fatal accidents as compared to the month previous, when eight were killed. Van Maasdyk, a Dutch aviator, lost his life when the motor of his machine stopped while in flight at Arnheim, Netherlands, on August 27. Another Dutch aviator, De Baeder, fell 100 ft. at Cambrai, France, and was killed. In America, Benny Prinz, an aeronaut and parachute jumper, fell a distance of 2,500 ft. at Asbury Park on August 12, during the course of an exhibition.

Charles F. Willard marked a distinct advance in flight by carrying four passengers in his biplane at Hempstead August 14. The machine rose in the air and was maintained on an even keel 20 ft. from the ground for a distance of 1,200 yd.

AN AMERICAN WOMAN MOTORS AROUND THE WORLD

Mrs. Harriet Clark Fisher of Trenton, N. J., who already enjoyed the distinction of being one of the few women engaged in the manufacture of steel products in this country, completed a globe circling tour in an automobile August 16, when she returned to her Trenton home after an absence of exactly 364½ days. With a party of three others and a ton of luggage, Mrs. Fisher left Trenton, August 17, 1909, for New York. The machine was placed aboard a steamer and conveyed to Europe.



(From a Photograph made in Japan.)
Mrs. Harriet Clark Fisher, and Her Globe-Circling Auto

After touring Europe the party passed into Asia, and went through India, China, Japan, crossed the Pacific by steamer, and traversed the United States in the automobile. A distance of 20,000 miles was covered in the car and something like 15,000 miles by boat.

Mrs. Fisher was received hospitably in all the countries she visited and in the Orient was treated with distinction. Part of the time while on the road, the entire party slept in the open, regular camp equipment being carried for this purpose. In India and Japan Mrs. Fisher was given elaborate entertainments.

¶An ink that has carbolic acid as one of its principal ingredients is now being used by the officials of the National Bank of Spokane, Washington, in signing national bank notes, thus making the first real antiseptic money issued in the United States.

New Rifle Being Tested at Camp Perry

NEW RIFLE DISCHARGES 500 BULLETS PER MINUTE

Riflemen assembled at Camp Perry, Ohio, for the target competitions under the auspices of the federal government, the state of Ohio and the National Rifle Association last month, watched with interest the exhibitions of the recently invented Benet-Mercier gun, which combines the rapidity of fire, range and effectiveness of a machine gun with the lightness and ease of action of a magazine rifle. The gun is fired from a rest and is held against the shoulder of its operator, who can either fire from a sitting position or lying prone. The regulation cartridge is used in clips that hold fifty. A good rifleman can discharge from 300 to 500 shots per minute, if assisted in feeding by a man to fill the clips. The gun is at present undergoing a series of tests by army officers with a view to its adoption by the government.

UNVEILING A STATUE BY ELECTRICITY

As it was impossible for the Duke of Connaught, uncle of England's king, to be in two places at once during the ceremony of unveiling the monument just erected in memory of the officers and men of the Royal Artillery who fell in the South African war, electricity had to be used as his assistant.

Standing in St. Paul's Cathedral, where he was attending the service, he pushed the button of a specially constructed electrical apparatus which caused the covering to be drawn away from the memorial, about two miles distant.

The statuary of the memorial represents war as a charger, controlled by a winged figure of peace.

Unveiling at a Distance by Electricity

BICYCLIST PERFORMS FEATS AT AVIATION MEET

That the aeroplane is not always enough to rivet the attention of the crowd is shown by the efforts of the

A Difficult Trick

managers of the Blackpool Aviation Meet in England to provide other means of entertaining the throngs that gathered to witness the daring of the airmen. Strathmore, the Dutch trick cyclist and equilibrist, was imported from Amsterdam to fill out the program between flights. One of the most difficult of his tricks was to ride around the field balancing with his teeth five chairs, piled one on the other.

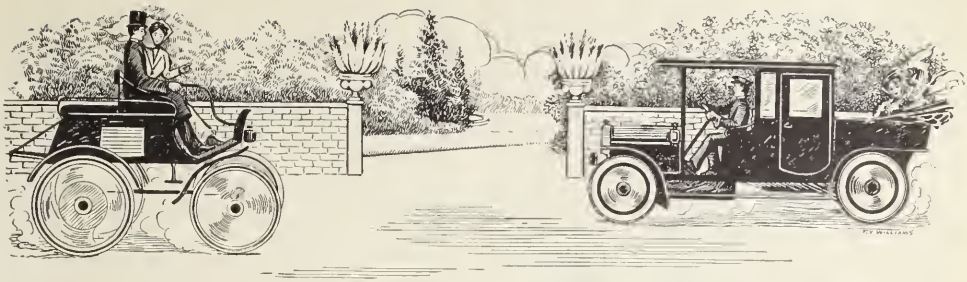
AUTO TRIP FROM COAST TO COAST IN TEN DAYS

In the motor car records of the United States, August 18, 1910, will be written as one of the red letter days of automobile history, L. L. Whitman having "checked in" at the foot of Market street, San Francisco, on that day completing a journey from New York in a four-cylinder, 30-hp. car in 10 days, 15 hr. and 13 min.—4 days, 10 hr. and 59 min. faster than the best time previously made from coast to coast. The distance covered measured 3,557 miles and the travel was continuous, night and day, from 12.01 A. M. August 8, when the start was made in New York, until San Francisco was reached. Mr. Whitman alternated at the wheel with E. I. Hammond. The only stops made were to take on fuel and make necessary repairs.

The route laid out for the trip took the car through Albany, Utica, Buffalo, Cleveland, South Bend, Cedar Rapids, Council Bluffs, North Platte, Cheyenne, Ogden and Sacramento. Fast time was made from New York to South Bend; heavy rains and muddy roads seriously interfered with progress between South Bend and Cedar Rapids. Tall grass, deep sands and the most primitive of roads were encountered from the Wyoming line to Reno.

CHESS ON SHIPBOARD BY WIRELESS

A game of chess, remarkable because of the distance which separated the participants and the means by which they kept in touch with each other, was recently played many miles out at sea. The opponents were Dr. Carment, aboard the "Morea," and a Mr. Miesters, aboard the Dutch steamship "Rembrandt." The game started while the ships, both bound for Colombo, Ceylon, were 150 miles apart, and continued 24 hours. Dr. Carment won the game on the 69th move. The moves of the players, who were strangers, were flashed from ship to ship by wireless.



WHAT BECOMES OF THE OLD AUTOMOBILES?

By ROY O. RANDALL

Autos, autos, everywhere,
And not a car that's old.

THIS metrical sentiment, slightly paraphrasing Coleridge, defines the daily impression of the casual observer, who, watching the boulevard's brilliant procession of whirring wheels, flashing brass and brightly enameled colors, in wonderment asks himself, "Where are the cars of yesteryear?"

What has become of the strange examples of motor car building which marked the beginning of the industry in America? Where are the high-wheeled monstrosities around which the gaping crowds thronged in the years shortly following the Chicago World's Fair? Whither have drifted the Panhards and other foreign red and blue "devils," so potent during that earlier period in arousing admiration and envy?

And the later models of American construction, say, of five, ten or a dozen years back. They appear to have vanished like the dinosaurus and the dodo.

If you would solve this mystery, which is far from lacking in human interest, go to the men who are selling the splendid and mighty cars of today, then to the second-hand dealers and, finally, to the junk man who will give you the last chapter of the tale.

From them you may hear the story in varying versions. Said the representative of one big automobile manufacturing company:

"The query, 'What becomes of the old automobiles?' reminds me of that other oft-repeated question, 'What is the life of a machine?' Into both there enter so many contingencies that I hesitate to answer. The history of an automobile, that is, a good one, from the time it leaves the factory until the scrap iron collector gets possession of it, is full of interest. Its first owner, ordinarily, is a man of wealth who runs the car one season, after which he becomes enamored of some new device on a later model of the same make, a new body design or some other feature, or switches over to an entirely different make of car and turns the old one in on his new purchase.

"Probably the car is in first-class shape and only slight repairs are required for putting it in excellent running condition. But it is second-hand. Notwithstanding that fact, a buyer usually is found who pays for it two-thirds of the original selling price. This second owner, not being of the flush money type, may operate the car until it approaches a degree of general decrepitude.

"He will then dispose of it, either to a second-hand dealer or to one of that class of buyers which has the 'auto bug.' This man is bound to have a machine and if it will run at the out-

set, he is satisfied—he is the owner of an automobile. After the third owner's modest salary fails to keep up with the steady outgo for repairs, the machine then falls into the hands of another 'bug,' who has the disease in the tertiary stage. After numerous doleful experiences and much 'doctoring' of the old wreck, the latter inevitably ending in failure, the junk man carts it away on his truck and finds a ready market for the brass lamps and trimmings, the rubber of the tires and the iron.

Its Last Resting Place—The Junk Pile

"There is another and less scrupulous sort of person who gets hold of an old, dilapidated car and, because it still is classified as an automobile, is able to take out insurance on it. A mysterious fire or explosion puts the car entirely out of business and, if the insurance adjuster is 'easy,' the owner of the car may make a profit on the nefarious deal."

One dealer was of the opinion that the average man on the street was deceived if he imagined that all cars he saw on the boulevards and elsewhere were new cars. "Don't fool yourself," he said. "There are hundreds, I almost said thousands, of cars running about that are old enough to be turned out to pasture. Why, an engine developing only one horsepower could move a small car over level boulevards. Many an old, broken-down car, glossed over with some nice enamel and with the brass parts polished up, is perambulating around. It's true that lots of the old machines go to the western towns and to the farmers, but not all of them by any means.

"Look, there goes one now." The dealer pointed to a car of the touring type. "That car probably is of the 1903 crop. And there are others still older. I can pick them out by the dozen. Farmers do get stung on second-hand cars that have been furbished up a bit, but so do the unsophisticated of the city. One class is no more ignorant than the other.

"These 'prospects' come to the dealer with very little knowledge and this applying only to two or three makes of cars. After they've been turned loose in dozens of shops they become bewildered. They have come here, though, to buy an automobile and

after they arrive at complete confusion they settle on the first thing that looks good to them at the price they are able to pay. Naturally they get stung right. They see a machine nicely varnished up, with its brass parts shining, tires in good shape and after a trip in the derelict, during which the car is piloted by an expert who gets all available power out of the engine, they fall for the game and sign a check. The tyro frequently is deceived, and intentionally, by conscienceless dealers with regard to the speed obtainable from an old car. In many cases the maximum speed possible with a wornout engine is from 12 to 15 miles an hour, maybe not more than ten.

"The demonstrator handles the car as only an adept of many years' experience can, and, arriving at the maximum of ten miles, he turns to his quarry and inquires: 'How does this strike you? She's running twenty miles now, maybe a trifle more than that. Believe you said you didn't want too fast a car.'

"'No-o-,' is the uncertain response, 'but you could let her out if necessary?' 'O yes,' the driver answers, 'certainly —up to 30 or 35. But we don't dare to take chances here on the avenue. The cops watch us all the time for speeding. They're on the job every minute. Got soaked 15 and costs last week.' This veracious statement satisfies the credulous buyer and he finds at the end of the ride that he has bought something. That's exactly what it is—some *thing*."

"The old cars? Why, there is no such thing as an old car," exclaimed one of the largest second-hand dealers in the country. "That is," he amended, "in some makes. Let me show you." He led the way to the rear of his spacious salesroom and pointed to a two-passenger car with top extending far forward which somehow was remindful of the Avenue de l'Opera or the Champs Elysee.

"French car? Yes, you're a good guesser. It's a Panhard of 1892—eighteen years old, originally built for four passengers. As you can see the car looks right, even at this late day, and it is, without exaggeration, still a serviceable car. The body has been remodeled and now seats are provided only for two. The owner holds this car at $500. Probably you'd be interested yourself? No?"

There are, indeed, many interesting features in the second-hand business and there are, if the truth be told, some handlers of cars who are not over scrupulous in their dealings with the more ignorant class of buyers. All they desire is to make a sale and the buyer who looks no deeper than the clean and shining exterior of a patched up machine always gets the worst of it. Would he buy real estate that way? Most assuredly no. Yet he will spend a thousand dollars or more on an antedated automobile with sublime recklessness.

The tricks in this new trade are legion. For instance, a salesman will tell the prospective buyer that a certain car is owned by a man or woman who has just obtained a divorce. A big price will be asked, but the salesman will say that the owner needs money and might take less. In some cases they operate with a confederate, who comes into the building while the customer is there and poses as the owner. Another scheme is to call up the imaginary owner on the telephone and, through a confederate working at the other end, probably stationed at a neighboring drug store, permit the 'prospect' to talk with this man who will tell a hard luck story and, reducing the price, will force a sale without proper demonstration of the car.

In every case the machine sold is the concern's own property and is in bad condition. Customers also are told that the machine they are interested in is owned by a broker or Board of Trade man who has suffered severe losses in recent speculation and must sacrifice a practically new car, in perfect condition, in order to raise money at once. These schemes are only a few of the many that are worked in the disposal of old automobiles.

Unlike man, whom a great poet gave

seven ages, the automobile has not more than four or five periods of transition from its place of origin to the "boneyard." Its tenure of life is brief but brilliant, like that of the butterfly.

Milady, speeding home from the matinee with a gay party of friends in her luxurious car, little dreams of that not distant day when a keen-eyed, weather-beaten junk man will be breaking up its frame for the few remnants of value which it may still possess. The gentle owner of the marvelous, fleeting vehicle is only conscious of its present magnificence and thrills at the thought of how far it surpasses the automobile of Mrs. Jones.

She sinks back luxuriously in the cushions and the machine, almost a sentient thing, rushes swiftly to its ultimate doom—sans body, sans wheels, sans tires, sans everything.

DISINFECTING SEATTLE WITH SALT WATER

Wholesale disinfection of the streets of Seattle by means of sea water is now being carried on by order of Commissioner of Health, Dr. J. E. Crichton. A number of cases of infantile paralysis have been found in the city, and after several deaths a strict quarantine of all cases was ordered. The state has co-operated in the work.

Seattle for the past six weeks has experienced an unusually dry spell, and physicians attribute the spread of infantile paralysis to dust. Alarmed at the spread of the disease, Dr. Crichton instructed the superintendent of streets to use sea water from Puget Sound, in laying the dust and flushing the streets.

"Salt water is the best germicide in the world," says Dr. Crichton. "The sea water contains seven grains of chloride of sodium to the gallon. Within a few days the city streets will become white with sodium chloride and the action of the sun's rays on this will produce chlorine gas, the best disinfectant known to science."

"SWEATING" GOLD COINS

Recent investigations of the secret service men in New York drew attention to a very interesting as well as very ancient method of procuring gold from coins without greatly defacing them.

The method is called "sweating," and consists of placing the gold coins in a burlap bag and shaking vigorously for an hour or so. The tiny pieces of gold thus knocked off the surface and edges cling to the bag. The coins are then removed and passed into circulation again, apparently no more worn or battered than most of the metal money a few years old. The burlap bag is burned, and the gold dust which remains is gathered up and melted.

The treasury at Washington has been getting back large quantities of gold coins, many of them not long out of the mint, which are short in weight from 5 to 15 per cent. The greater number of the maltreated coins are of the $20 denomination, and some of them lacked $2 or $3 in actual value of gold. When placed under the microscope by experts, it became evident that the coins had been handled with violence, and the large number aroused suspicion.

JENATZY BREAKS OLDFIELD'S SPEED RECORD

The record of having traveled the fastest of any human being is now held by Camille Jenatzy, the Belgian who recently broke Oldfield's record at Ostend, Belgium. He did the flying kilometer (3,280 ft.) in 16 4-5 seconds, which is at the rate of 133.1 miles an hour. Oldfield's record-breaking run, made at Daytona, Florida, last March, was at the rate of 131.28 miles an hour.

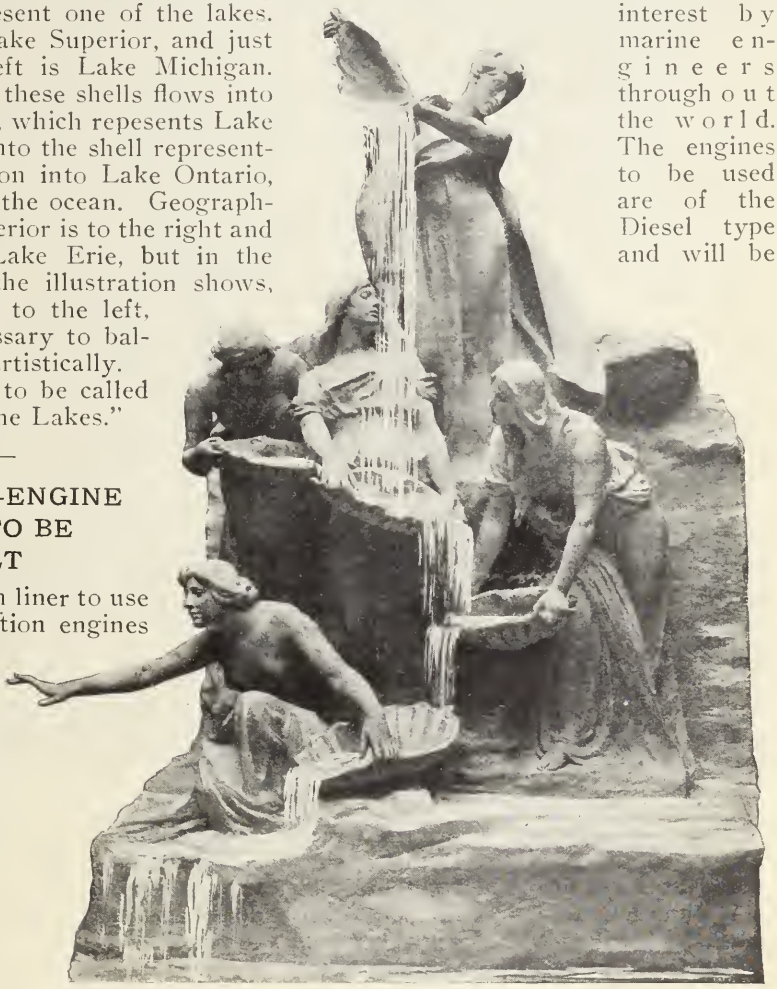
Jenatzy, however, is not to be granted the official record because he made only one trial, whereas the rules call for two.

"THE SPIRIT OF THE LAKES"

Lorado Taft's beautifully sculptured group, symbolical of the Great Lakes, is being cast in bronze and will soon be erected just south of the Art Institute on Chicago's lake front.

The shells and the figures holding them each represent one of the lakes. At the top is Lake Superior, and just below to the left is Lake Michigan. The water from these shells flows into the central shell, which repesents Lake Huron, thence into the shell representing Lake Erie, on into Lake Ontario, and thence into the ocean. Geographically, Lake Superior is to the right and a little above Lake Erie, but in the monument, as the illustration shows, it is below and to the left, this being necessary to balance the group artistically.

The group is to be called "The Spirit of the Lakes."



Symbolical of the Great Lakes

FIRST GAS-ENGINE LINER TO BE BUILT

The first ocean liner to use internal combustion engines is planned by the Hamburg-American line for a test in its Atlantic service. A vessel of 9,000 tons will be equipped with engines of 3,000 hp., which are expected to propel the craft through the water at the rate of 12½ knots per hour.

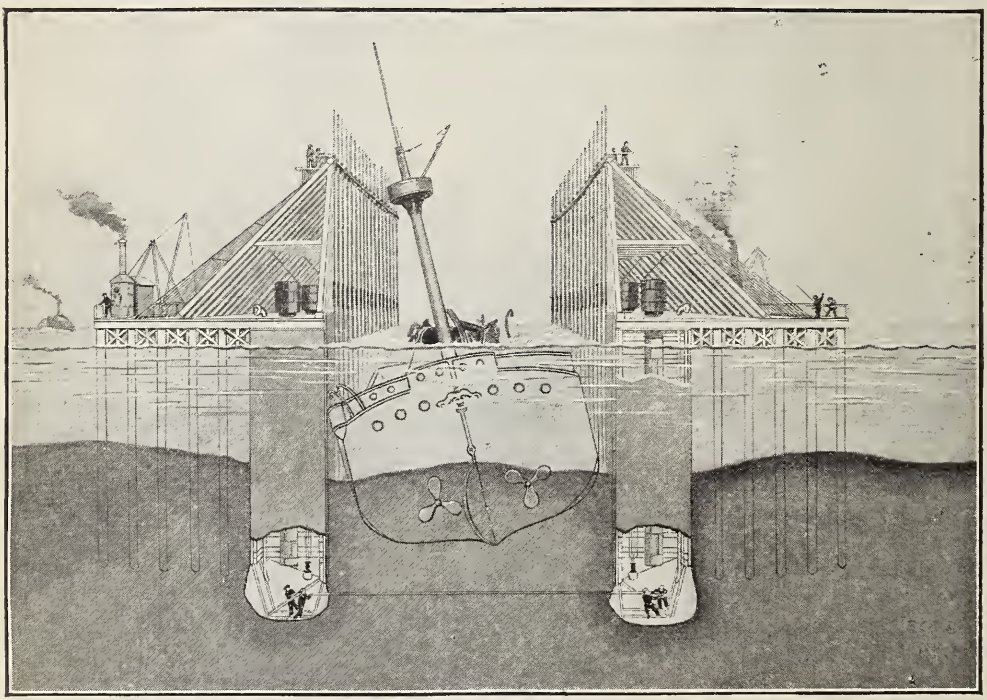
All of the best features of steam-driven ships are to be combined with the convenience and space economy of the gas engine. There is expected to be an enormous saving of space in the new liner by reason of the absence of boilers and smokestacks. The fuel storage sections will also be smaller than the coal bunkers would be on a vessel of this size. This will, therefore, give the ship a greater cargo-carrying capacity than any vessel of the same tonnage afloat.

The experiment is being watched with intense interest by marine engineers throughout the world. The engines to be used are of the Diesel type and will be two in number, each with a rating of 1,500 hp. The vessel will have twin screws. Crude oil will be used as fuel.

¶Money must not be sent in a letter to Greece. The person receiving the letter will be fined.

A PROPOSED METHOD OF RAISING THE "MAINE"

One of the most practical plans submitted to the War Department for the raising of the "Maine," for which purpose $300,000 was appropriated by Congress, is the idea of a New York engineer, who proposes to undertake the work for the government under the general direction of army engineers.



A Plan for Raising the "Maine"

The depth of water where the wreck lies is about 35 ft., overlying a soft, muddy bottom into which the hull has sunk another 10 ft. The New York engineer's scheme, briefly put, consists in raising the vessel on a cradle of cables, slung under it by means of 12 pneumatic caissons, placed six on each side. These caissons are to be 15 ft. wide by 40 ft. long, sunk side by side as near together as possible, and as close to the side of the wreck as the various projections will permit. The cables it is planned to pass under the hull number 60, so disposed that they may be simultaneously tightened and raised by derricks arranged on the docks.

The first step in the scheme is to drive, on either side of the wreck and about 20 ft. from it, an ordinary timber dock, supported by straight and battered piles, driven well down into the soft mud bottom. The plan calls for docks about 40 ft. wide, so that the outside edges will be about 60 ft. away from the vessel's sides. Between these docks and the sides of the hull the caissons will be sunk to a depth of about 10 ft. below the bottom of the hull. Pipes will then be driven under the hull from caisson to caisson, and the cables led through them, until all 60 are in place.

¶ Following an order from the Department of Agriculture, an attempt will be made to prevent importation of the English starling into this country. The starling is classed as an undesirable bird, being an eater of small grain.

EDITORIAL

AS aviation progresses, new and unexpected difficulties and dangers present themselves. The latest is that of destruction from lightning. While gas balloons have been frequently struck, it has been supposed there was some special attraction in the displacement of the air by a lighter body, which attracted the electric current by furnishing a course of less resistance to its passage. This theory may lose some of its force now that an aeroplane has been struck by lightning. Whatever the cause, the unpleasant fact remains that aeroplanes are not exempt, and that lightning rods to ground the current are impracticable. Rival lines of passenger airships may some day offer as a special advantage that their routes are laid through zones free from thunder storms.

* * *

THE Brennan monorail car, which maintains its equilibrium by means of gyroscopes, is making little headway in the direction of practical railroading. The system appears to have progressed to the point of demonstrating what can be done, but has failed to connect with any hard, every-day matter-of-fact service. At present, it is found among the flip-flaps, scenic railways and other amusement devices at the Anglo-Japanese Exhibition in London, but owing to unexplained reasons, is out of commission, being closed for "repairs" a good part of the time. Apparently the Brennan system is one of those interesting, curious things which, while they can be done, are not worth doing. Railroad managers in England do not consider the system seriously.

* * *

THE Post Office department, which only a year ago was on the verge of bankruptcy on account of the alleged enormous loss of carrying magazines and newspapers at one cent per pound, has managed by the introduction of business methods to reduce its deficit $11,600,000 for the fiscal year ending June 30, 1910. Inasmuch as no one claims there are any less copies of periodicals going through the mails than heretofore, the contention of the publishers that the deficit was caused by bad management rather than too low rates of postage, seems to be verified. If now all other branches of Government should be charged for their mail, as is done in most countries, instead of its being franked at the expense of the Post Office department, there would be little or no yearly deficit. A year ago this year's loss was predicted to be $20,000,000. It is only $5,500,000.

* * *

THE United States is about to undertake tutelage of the little republic of Liberia, on the west coast of Africa. It was founded in 1820 by the American Colonization Society as a home for slaves from this country who had secured their freedom. It became a republic in 1847. It now contains about 60,000 Liberians along the coast, and 2,000,000 wild negroes in the interior. With the consent of Liberia and approval of the leading European powers, the United States is arranging through American, French and German bankers to float a loan of $2,000,000 necessary to put Liberian finances in shape; the sum to be repaid chiefly from customs on exports, of which rubber is the largest. The United States will assist Liberia to get on a firm basis, by taking charge of its financial, military and agricultural departments, and foreign relations. English papers welcome the advent of the United States as a new power in Africa, and the Daily Mail says "this is a change which will affect future history as perhaps no other event in the last twenty years, with the single exception of the fall of Port Arthur." In Liberia no white man is allowed to acquire citizen's rights, or own property. It has no standing army.

* * *

AEROPLANE speeds started at 35 miles an hour and have increased to 66 miles. At the present time, a steam locomotive can outrun an aeroplane. However, air speeds of 100 to 200 miles an hour, are within the range of reasonable expectation; some aviators even seriously dream of 300 miles an hour. Further development seems contingent on engine construction.

Increased power with less weight is the demand, and must be obtained before any substantial increase in speed can be hoped for. The ratio of increased power necessary for each addi-

tional mile of speed per ton of ship, has been accurately determined. Whether high speeds through the air will be correspondingly extravagant of power is yet to be worked out. The problem of increased speed for aeroplanes is now up to the engine builders.

* * *

OWNERS of automobiles throughout the country are rapidly bringing upon themselves some rigid restrictions which they will not enjoy. Reform legislation is always slow in coming, and for that reason generally goes farther than is necessary. It seems to be a case of the breaking loose of pent up waters. The annoyances referred to are the unnecessary use of horns, whistles and exhaust. Many drivers seem to have a mania for making all the noise they can, lest some should fail to realize they are in a moving car. The smoke nuisance is equally unnecessary and offensive, and that it also can be prevented is demonstrated in nearly all European cities where heavy fines are imposed for violation. The result is a smoking car is seldom seen, for other drivers immediately call attention of the offender to his car.

The motorcycle is even more offensive in its noise making: This, too, is equally unnecessary. The motorcycles in England make no more noise than a sewing machine. The public has about reached its limit of endurance of these disturbances of the peace, and unless the offenders promptly reform themselves, city ordinances should and will be passed and enforced without regard to who the offender may be. This is an instance where a ten or twenty-dollar fine will work a prompt and permanent cure.

* * *

THE extensive peat undertakings which were started in Ireland about two years ago, on which large sums were expended, and of which so much was promised, have verified the prediction made in these pages and proved a failure. It is the old story over again, the cost of getting rid of the water, which constitutes 90 per cent of the weight of freshly dug peat, and the expense of a suitable binder to prevent the briquettes from crumbling before they are used, amount to more than the cost of coal. Attempts to make paper from peat were equally disappointing. It is evident that if peat is to become a practical fuel within the next one or two hundred years, it must be as the result of a different and cheaper method of digging, drying and preparing than any yet employed.

* * *

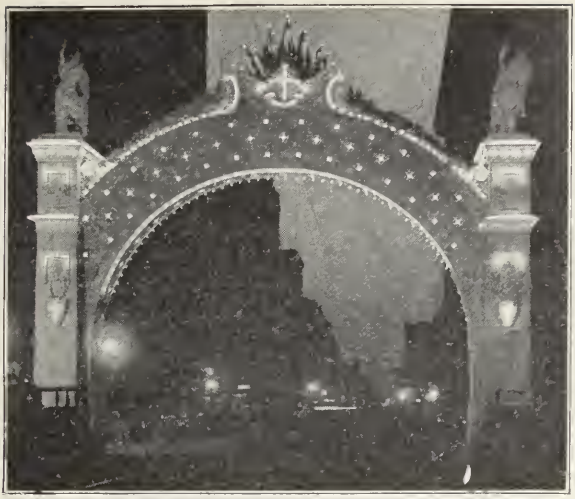
EXPORTS to South America, of goods and machinery made in the United States, are growing in volume each year, but at a rate far below our possibilities. Meanwhile Germany and England are becoming so strongly entrenched in those markets that we may never regain the lost ground, and if regained it will be only at great expense. One of our weak points is the self-confidence of our manufacturers as to the great superiority of our goods. In a few instances, like harvesting machinery, this is justified, but when it comes to articles of wear and household use, we make many mistakes. The form most popular here, and best suited to our own trade, is often very unsatisfactory to foreign buyers and users. Just as nations differ in the cooking and serving of their food, so they differ in their other wants. English and especially German manufacturers give great attention to this phase of foreign trade, and are not only willing but anxious to furnish an article in its most acceptable form. If a certain market demanded pails with two handles, the Germans would lose no time in argument as to the inutility of the extra handle, but promptly put it on—and charge accordingly. It is evident the man who wants a given article of a certain forming, is going to buy it where he can get what he himself wants, rather than what some manufacturer thinks he ought to have.

The logical first step to any export trade is to visit the market sought, and learn at first hand what are its requirements. Getting into a foreign market is like planting a new kind of seed, which promises a large and valuable crop. With only a limited number of seeds, before breaking ground one would study all the details of its culture, and then take pains to plant in the right place, at the right time and in the right way.

Export trade requires the same treatment.

H. H. WINDSOR

One of the Columns



La Salle Street Arch at Night

On "Templar Way"

How Chicago Handled the Knights Templar Parade

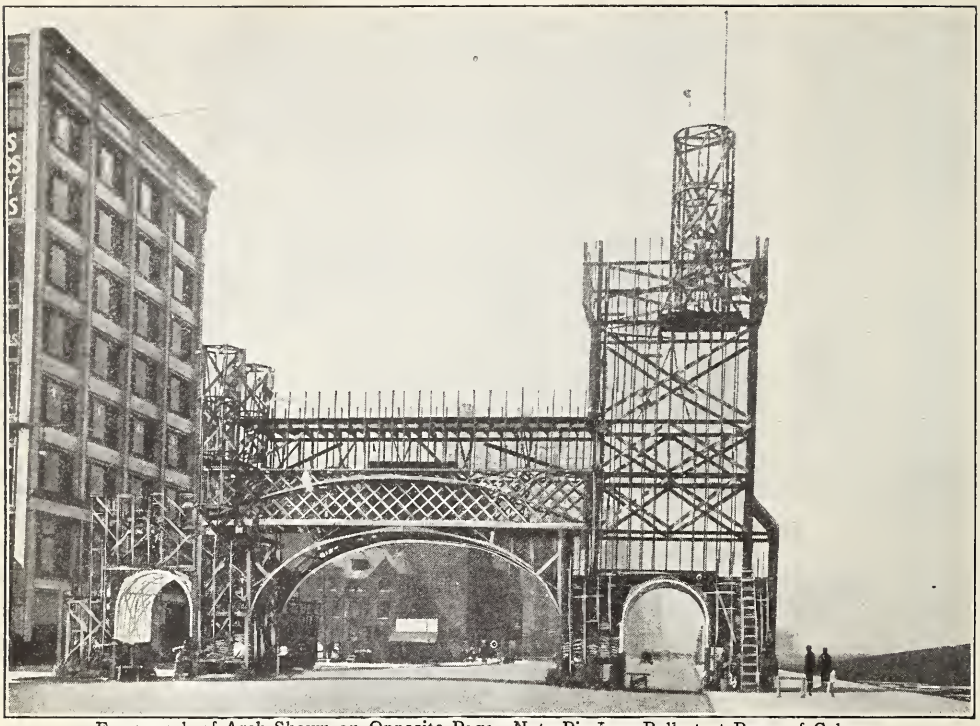
By HENRY W. RIDGE

THE services of an artist, a sculptor, an architect and an electrical engineer, in addition to riggers, carpenters and seamstresses are necessary in these modern times for the decoration of large cities planning to entertain thousands of visitors on occasions of great gatherings. So important has the business of decorating cities become that it is now a recognized trade, and there are eight big firms that practically control all the work done in the country.

The old system of promiscuous decoration, here, there and everywhere, has given way to carefully worked out schemes of symbolic character that carry through a general idea. The citizen will still deck his home as it suits his fancy, but the main streets of a city are now cared for by professional trimmers and builders employed by a general committee in charge of the affair.

The triennial conclave of Knights Templar in Chicago last month was made the occasion for the most lavish decoration of a city ever seen in the United States, with the exception of the Hudson-Fulton celebration in New York. It is estimated that $200,000 was expended on this feature of the entertainment of the knights. This work was done in sections by three of the largest companies in the business, each being called upon to look after the branch of the business in which it was most proficient. Ten carloads of material, in addition to the mass of bunting, flags, etc., obtained locally, were used. The general scheme followed the line of the big Templar parade, winding through the streets over which the route was laid and beginning on Michigan avenue and ending on La Salle street with massive arches, while the central portion of the plan included a long, straight "Templar Way" along State street, lined with stately pillars, festooned and connected with ropes of laurel.

The first of the arches represented the entrance to an ancient castle with its watch towers and battlements. Extending for a quarter of a mile from



Framework of Arch Shown on Opposite Page—Note Pig-Iron Ballast at Bases of Columns

Illuminated Sign, 70 ft. High

this arch was a reviewing stand with a seating capacity of 50,000, in the center of which was a canopied dais, where the Grand Master reviewed the marching hosts. At a central point was an illuminated Templar emblem, built on a framework 70 ft. high, the bottom of the emblem being about 15 ft. from the ground, so that, when illuminated at night, it had the effect of being suspended in the air. Along "Templar Way" the tall, white pillars alternated in the general scheme with black electric light standards from which floated colored pennons and Templar banners.

The arch at the end of the parade was a dignified white structure of imposing design, symbolic of victory and chivalry. Its principal features were two horsemen, placed on top of the huge, square columns that supported the span. These figures were life size and represented two knights, armed cap-a-pie, mounted on prancing steeds. They were pure white, as was the remainder of the arch. Of the two arches this last was the most expensive, al-

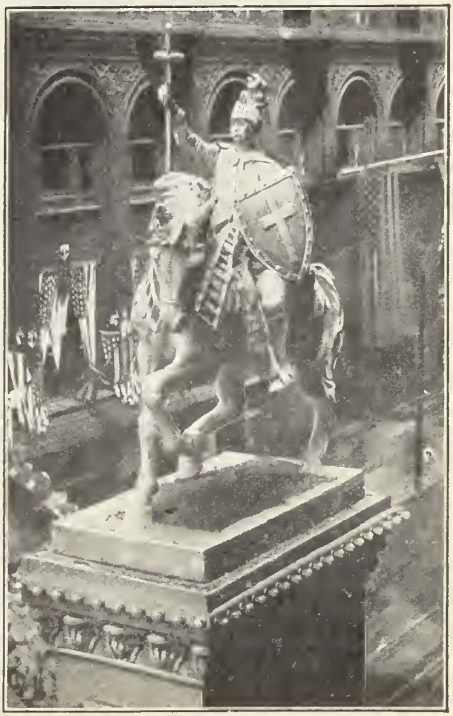
The "Templar" Arch on Michigan Avenue—Company of Arriving Visitors Passing Through

though it was not as large as the Michigan avenue structure. Its construction called for the services of a sculptor, as well as an artist and electrician. Skilled workmen were necessary to fill out the original models made by the artists.

In erecting the arches the builders could not anchor each column to the earth, as the concrete sub-base of the pavement could not be penetrated. The arches were built up of heavy timbers carrying latticed girders.

The main frame of each column in both arches consisted of a square base made of 10 by 12-in. timbers, on which six 6 by 8-in. uprights were set to carry the arched framework. A platform was built inside the rectangle formed by the uprights, about 1 ft. from the base in each of the columns. Six tons or more of pig iron were placed on each of these platforms as a ballast. No bracing was required in any way to keep the arches rigid.

The woodwork was covered with cloth, and the Michigan avenue arch



One of the Plaster Statues on Arch

was painted to imitate rough hewn stone. The casts for the horses and panels of the La Salle street arch were made up in parts and joined together when placed in position. The plaster was laid over hay and wire mesh attached to a light frame of metal. The metal parts were so arranged as to make them easily joined. After the parts were put together, the joints or seams were filled with plaster and smoothed over.

The handling of the crowd of 300,000 people attending the conclave was cared for in an exceptional manner by 1,600 members of the regular police force. With the exception of 25 detectives sent from other cities to help out the local force, no extra men were required for the work.

On the day of the great parade there was estimated to be a million people along the route of march, which covered five miles. There were 14,041 marching men in line, led by 64 bands, forming a procession 10 miles long. The streets through which the knights marched were roped off the night before, openings being left at crossings.

Seven ambulance stations were established at intervals along the route and there were patrol wagons posted at five other points. About the center of the line a temporary hospital was erected, these relief stations employing in all a corps of 100 physicians and nurses. These were designed to care for spectators who might become exhausted.

At the point where the route ended and the procession was disbanded, a platoon of 60 mounted policemen was stationed. These were re-inforced by 50 more mounted men, known as the "beauty" squad, which had led the procession. Cards which contained note of the number of men, and explicit directions as to the route they should follow returning to their headquarters were made out for each organization in the parade. These cards were made in duplicate, one being given to the commander of the organization named upon it and the other to one of the squad of 110 mounted policemen. As soon as the organization reached him, the policeman took charge of its march and led it back to its hotel, but by a different route from that taken by the preceding organization. The crowds on the streets naturally followed these retreating organizations with the result that as the big column broke into small integrals, and these units marched off in different directions, not only was an orderly retreat of the marchers accomplished without congestion of the thoroughfares, but the streets were cleared as though by magic of the throngs that had waited to witness the parade, the natural impulse to follow the uniformed men having been relied upon with perfect confidence for this purpose.

DEFINITIONS OF ENGINEERING

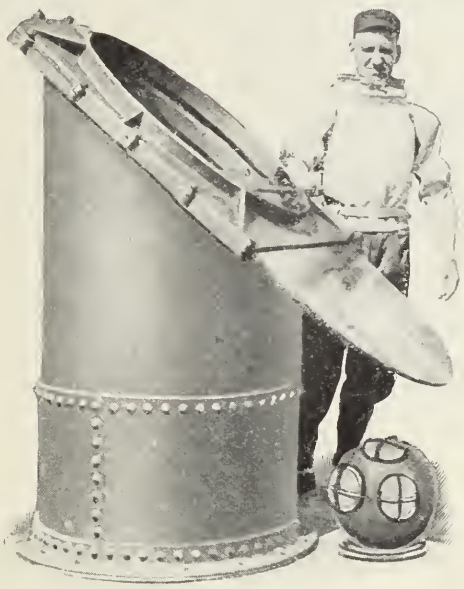
The definition of engineering most generally accepted until a year or so ago was that given by Tredgold in 1828 and embodied in the application of the Institution of Civil Engineers of Great Britain for a charter. It defines engineering as "the art of directing the great sources of power in nature for the use and convenience of man."

It has long been felt that his definition is not sufficiently comprehensive, and the definitions given by Henry G. Stout in his address as president of the American Institute of Electrical Engineers, and by Prof. G. F. Swain in an address at the Worcester Polytechnic Institute, are improvements.

The former defines engineering as "the art of organizing and directing men, and of controlling the forces and materials of nature for the benefit of the human race." The latter defines it as "the science and art of applying, economically, the laws, forces and materials of nature for the use, convenience or enjoyment of man."

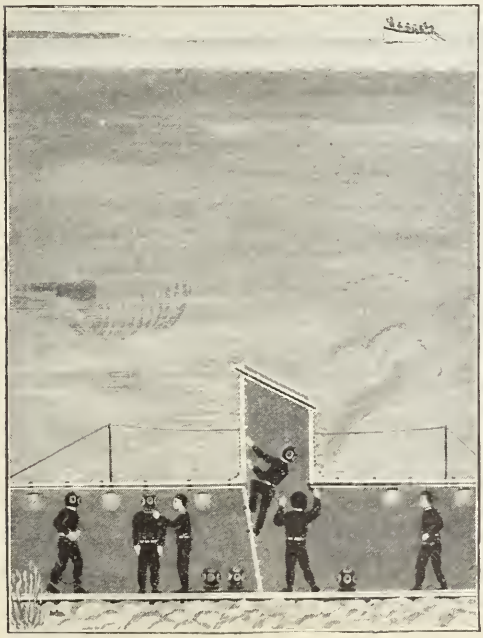
NEW MEANS OF ESCAPE FROM A SUNKEN SUBMARINE

The fatal accident to the French submersible "Pluviose," in which the entire crew was trapped and drowned, has added impetus to the endeavors of inventors all over the world to provide adequate means of escape to the surface. One of the new types of apparatus advanced for serious consideration is the idea of a Baltimore inventor, who takes an airlock such as is used in caisson work and adapts it to the requirements of the submarine.

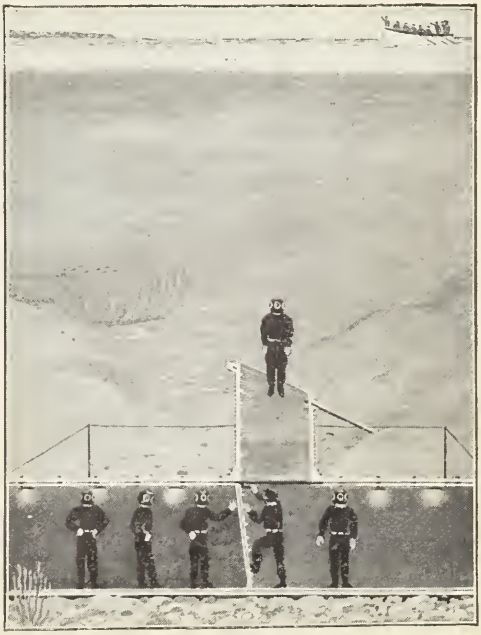


The Escape Tube and Its Inventor

It is a steel tube about 5½ ft. high, and 27 in. in diameter, provided with valves to allow the admittance and ejection of the water required to equalize the pressure inside and out. It is provided with a sliding door at each end, the upper one sloping at an angle of 45 deg., and sliding on roller bearings. In the interior of the tube, on one side, are rungs by which the escaping member of the crew may climb into position for escape, while a portable ladder gives access to the tube from the in-



Climbing into Position, Upper Door Closed, Bottom Opened



Shooting Up to the Surface, Top Opened, Bottom Closed

terior of the submarine. The method of escape is clearly shown in the illustrations. The lower door, shutting off the tube from the interior of the submarine, is opened, and one of the crew provided with a self-contained air helmet and jacket, climbs into position. Then the lower door is closed, water is let into the tube through the valves, the upper door is slid back, and the escaping member shoots to the surface. After the upper door is again closed, the water is forced from the tube by means of the valves, the lower door is opened, and a second member of the crew ascends.

MINNESOTA'S INDUSTRIAL PROSPERITY

Substantial industrial prosperity is responsible for the reduction of taxes throughout the state of Minnesota contemplated by the state officials this fall. The mines, the railroads and the varied branches of manufacturing that find home in the state have justified the predictions of the officials that a decrease in the levy on the individual citizen would result. They have backed their prediction with the flat statement that at least half a million less in revenue would be necessary next year, and are taking steps to reduce the levy to one-half mill, the lowest in the history of the state.

Minnesota derives its revenue from a tax of four per cent on the gross earnings of the railroads, on the earnings of other corporations, and a direct levy of one mill on all taxable property, including the iron mines. This year the first named source netted the state $4,000,000 and the last mentioned $1,100,000. There was also paid into the treasury this year $800,000 of deferred railroad taxes that had been in litigation and $345,000 of inheritance tax.

The iron mines, or land containing iron mines, are assessed under an ad valorem basis to the amount of $205,000,000. A portion of the mines are on state lands held under lease, the lessee paying 25 cents a ton royalty for each ton of ore. This income goes into what is known as the permanent trust funds for schools, the university and swamp lands. These funds are kept as perpetual funds and only the interest can be used.

TO TEST EFFECT OF FORESTS ON STREAM FLOW

The recent clash between the United States Forest Service and the Weather Bureau over the question of the effect of forests on river stages has drawn attention to the fact that there is but few real data on the subject. Consequently, these two departments of the government are to undertake a joint series of investigations expected to take about 16 years.

The plan is to make a very complete study of the effects of forests upon stream flow, erosion, disposition of silt, etc., as well as their possible meteorological relations, on two watersheds of similar topography near Wagon Wheel Gap, Colorado, in the Rio Grande National Forest. The dams and instruments for the measurement of the stream flow, together with complete equipment of meteorological apparatus, will be installed at an elevation of 9,500 ft. above sea level.

The intention is to measure the flow of the two streams for a period of about eight years, which is long enough to show, with similar forestration, the behavior of the two streams. Then one of the watersheds will be cleared, and further measurements will be continued for another period of eight years. Thus the effects of the removal of the forests can be determined by comparing the results of observations in the two tracts.

¶Only one passenger was killed in the United Kingdom during the past year by an accident to a train in which he was traveling.

WONDERFUL BUDDHIST CAVE-TEMPLE

About three hours' journey from Bombay, India, in the face of a steep cliff, is a curious Buddhist cave-temple, an interior view of which is here illustrated. It is considered one of the largest and most complete specimens of the Buddhist "chaitya," and was probably built 78 years before Christ, by Maharajah Bhutia.

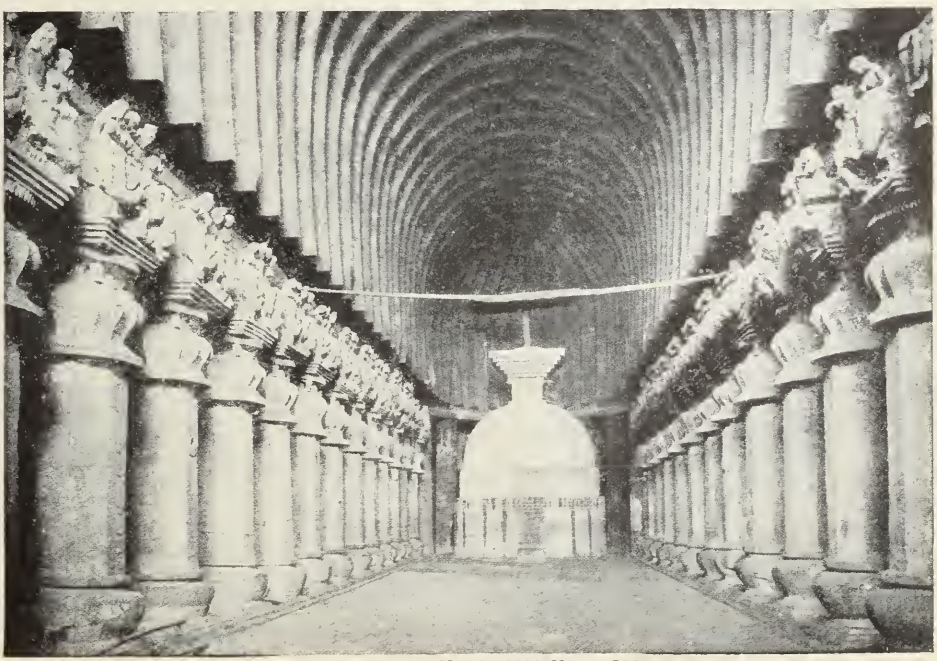
The interior architecture—there being, of course, no exterior architecture—resembles to a remarkable degree that of the Gothic type. It is not unlike the Christian church in form, consisting of a nave and side aisles terminating in an apse. Some 15 pillars separate the nave from the aisles, and the capital of each is richly ornamented with the figures of two elephants bearing a man and a women or two female forms.

The method of lighting is very solemn in its effect. An undivided volume of light comes through a single opening overhead and falls on the altar, leaving the rest of the temple in comparative darkness.

UNIQUE PHOTOGRAPH OF BEAR CUBS

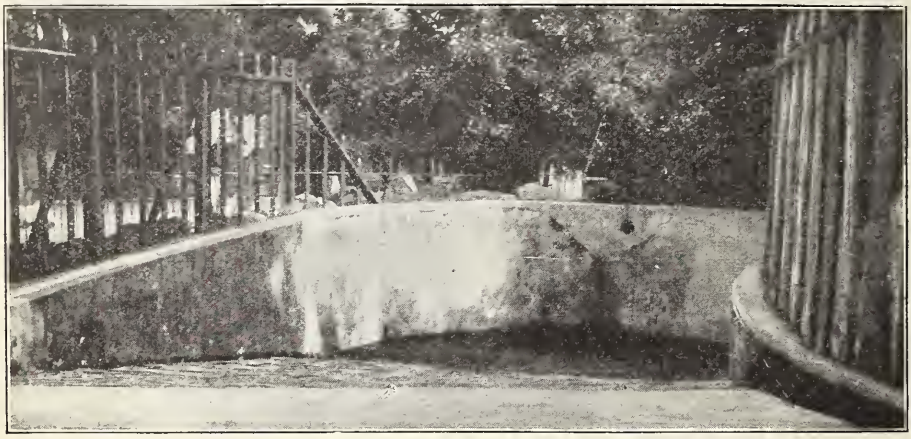
Among the prisoners at the Federal jail in Seward, Alaska, are two bear cubs belonging to one of the attachés of the place. The little fellows are firm friends ordinarily, but they have their little differences, just as do their human fellow prisoners. One of these

Bear Cubs Fighting It Out in Seward, Alaska, Jail Yard



Buddhist Temple Nearly 2000 Years Old

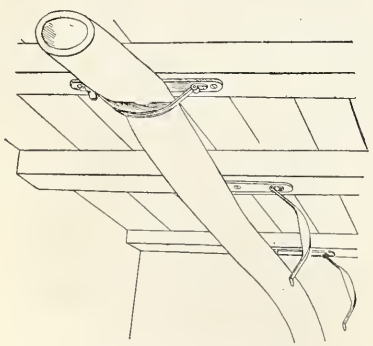
little squabbles gave opportunity for a remarkable photograph which showed the two bears standing erect just ready to "go for" one another, their attitudes suggesting the positions of two prize fighters sparring for an opening.



Where the Government's Elephants Bathe

AUTOMATIC HOSE BRACKETS

A fire-hose clamp which protects the hose when not in use, and brings it into play automatically when water passes through it, is drawing much attention, especially for use on steamships,



Hose-Hanging Clamp

wharves, railroad terminals, warehouses, and other places where fire hose is required.

The hose clamps or brackets, when fastened to the deck beams, bulkheads or floor rafters, hold the fire hose ready for instant use, but the pressure of water through the hose at once releases the latter, allowing it to drop to the floor, deck or foundation below. How the swelling of the hose accomplishes this is clearly shown in the illustration.

BATHTUB FOR ELEPHANTS

A huge concrete bathtub, 40 ft. wide and sloping down to a depth of more than 15 ft., has been built in the National Zoological Park at Washington, D. C., for the use of the elephants. A strong wooden barrier encloses the bathtub and effectually prevents the animals from rambling off through the park after they have enjoyed their dip. The bottom of the tank is paved with rock, which prevents the big fellows from slipping, as they surely would do if they tried to maintain their balance on a concrete floor covered with slime.

The bathtub has vastly improved the health and temper of the elephants.

¶The tungsten deposits in Washington, which will be developed within the next year, are said to be the richest in the world.

¶Moving pictures of the grewsome scenes attending the recent fatal railroad wreck near Middletown, Ohio, were being made less than an hour after the collision occurred.

PLAN TO REMODEL BRITISH ROYAL RESIDENCE

All England, and especially London, is interested in the idea of either remodeling or completely rebuilding Buckingham Palace, the royal residence in London. The front of the palace, which is constructed of Bath stone, has a peculiarly forbidding aspect. It is not considered a fit residence for the ruler of a great empire, and is an eyesore to London. It is said, in fact, that not a sovereign in Europe has such an unsuitable residence.

Many of the organizations and persons behind the movement to provide a suitable royal residence in London believe that the initial conception was so entirely faulty as to make impossible any alterations in the present structure. Others insist that the interior has many admirable features, and that the outside appearance can be so remedied that it may be possible to enlarge and remodel the palace in time for the coronation of King George next year. Complete rebuilding would require a much longer time.

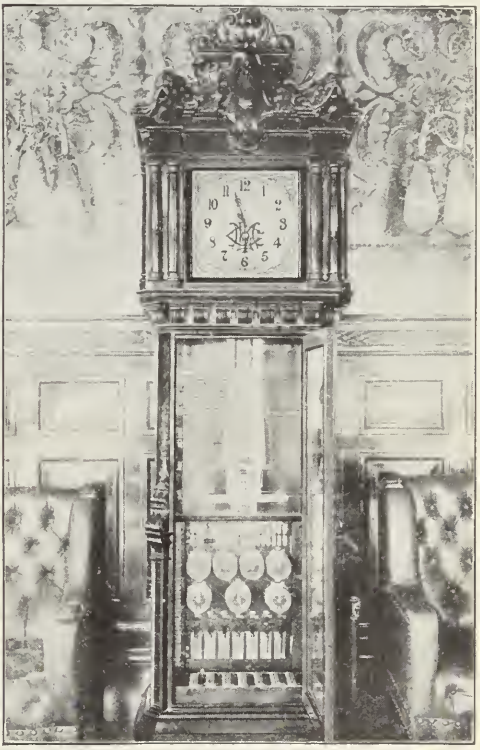
THE WORLD'S OUTPUT OF METALS

The world's metal statistics, compiled annually in Germany, give the production for the year 1909 as follows: The production of copper was 844,100 tons, or an increase of nearly 100,000 tons over 1908. Of this amount the American output was 498,200 tons, and the American increase over 1908, 66,300 tons, or more than half the total increase for the whole world.

The output of lead amounted to 1,081,900 tons, of which the United States produced 339,700 tons; the output of tin was 108,300 tons; the production of zinc was 783,200 tons, of which the United States was responsible for 240,446 tons; the total output of nickel was 16,100 tons, the United States being credited with 9,000 tons, and the output of aluminum was 24,200 tons.

MASTER CLOCK A MASTERPIECE OF THE CRAFT

The master clock, which is the heart of the time-keeping system in the Met-

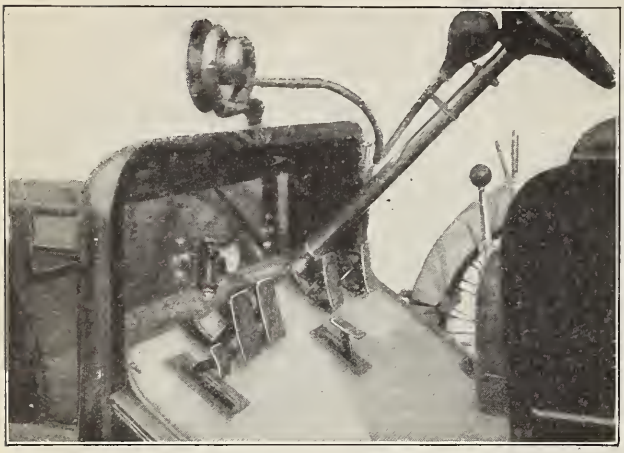


Regulates Clocks in the Metropolitan Building

ropolitan Building, New York, regulating the enormous clock in the tower as well as a hundred others throughout the building, is a beautiful specimen of the clockmaker's craft. Various instruments for sounding bells in different parts of the building at scheduled hours are also controlled by this clock. It is so delicately adjusted that it never varies more than five seconds a month. Installed within it are numerous controlling devices, from which impulses are transmitted every minute to the tower clock, 346 ft. above the sidewalk, keeping it in perfect synchronism with the master clock. It is located in the directors' room of the building.

¶Rural letter carriers will be receiving tellers for postal savings banks.

SPECIAL AUTO FOR TRAINING BEGINNERS



Auto Provided with Double Set of Controls

A special training automobile, with which it is possible for the instructor to turn the steering wheel and control mechanism over to his pupil and still retain control of the car, is here illustrated. This is accomplished by means of the extra set of clutch and brake pedals, and the special "decelerator" pedal.

The automobile was equipped in this way for the beginners' department of the Royal Automobile Club, London.

DEVICE ALLOWS STREET CARS TO RUN OVER FIRE HOSE

A simple contrivance that fills a long felt want in cities where there are many trolley lines and railroad tracks, has just been introduced in the Boston fire department. As is the rule in all large cities, fire hose laid across railway or railroad tracks are "sacred," and must not be crossed by cars. This has resulted in a general tie-up of traffic at times, cars being stalled for hours, or delayed by having to take a roundabout route.

A track section, built up on a strong T-shaped plate and beveled down at each end, enables a car to pass up from the regular rail, over the hose and down again without injuring it, and to continue on its way without interfering with the work of the fire apparatus. This is used where auxiliary lines of hose are laid across tracks that are not within the fire lines. Of course it is not used where there would be danger if the car entered the fire zone, which is kept cleared to enable the firemen to fight the flames, as heretofore. But where many hydrants are tapped outside the immediate fire lines, as is necessary during a big fire, it is invaluable, keeping traffic moving, and the streets in the vicinity of the fire clear for the apparatus. The hose passes under the crossover section, which is built high and strong enough to protect it. Every blockade costs a trolley company hundreds of thousands of dollars, which can now be saved by this simple device.

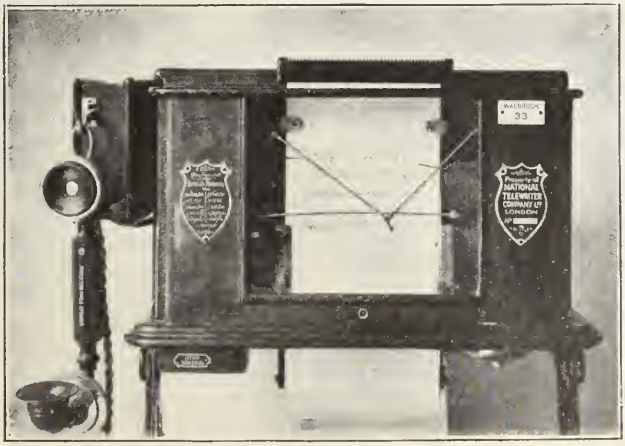
Prevents Street Car Blockade Caused by Extension of Fire Hose Over Tracks

TELEWRITER ATTACHED TO TELEPHONES TRANSMITS HANDWRITING

The "telewriter," an apparatus by which handwriting may be transmitted over a wire to distant points as fast as the person at the sending end of the wire can write, is being attached to a telephone service in London. It works in connection with the telephone without any interference with the ordinary service, the connection being automatic. Lifting the telephone receiver makes connection with central, and lifting the pencil throws the telewriter into service.

Sending Apparatus

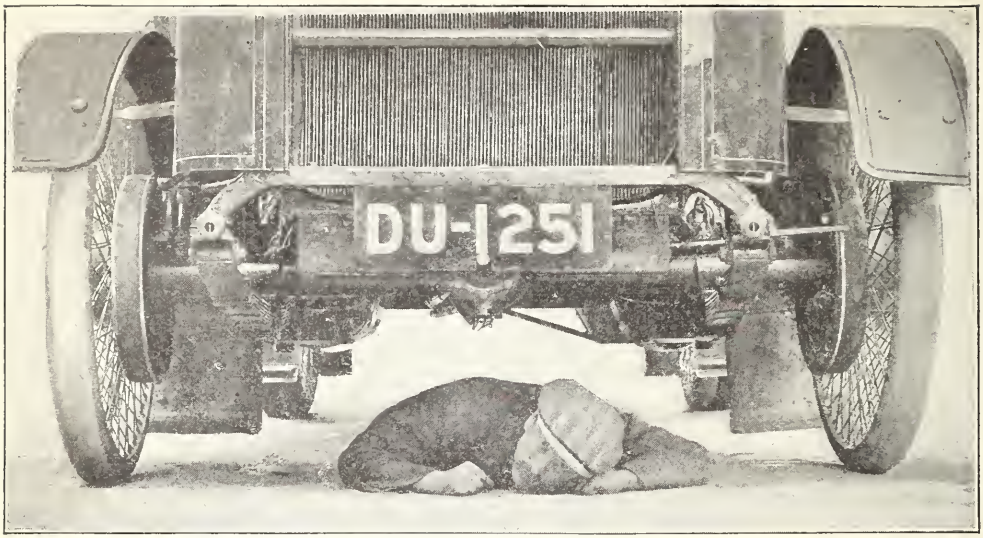
If a person telephones another and finds him not at home, all that is necessary is to take down the pencil and write a message, which is reproduced on a similar roll of paper at the other end of the line. The arms of the pantograph connected with the transmitting pencil regulate the electrical currents which are sent over the wire to the receiving pencil. The synchronous movement of the pencils thus produced transmits letters, figures or drawings in the exact penmanship of the writer.



Receiving Apparatus

OIL NUISANCE IN HARBORS

The steadily growing use of fuel oil on British ships has resulted in polluting the harbors to such an extent that the Admiralty has ordered that all possible precautions be taken to prevent leakage or discharge into the waters of all British ports. A ship due for the periodical survey of hull, and requiring to empty her oil fuel tanks for the purpose, must communicate with the captain of the dockyard and naval store officer, so that arrangements can be made for an oil storage vessel. As much oil as possible is to be discharged into the storage vessel, care being taken to avoid leakage overboard through the hose connections. The ship must then flood its tanks, and, if practicable, proceed to sea to pump the oil and water overboard. Otherwise, she must anchor outside the harbor in such position that the oil be carried well out to sea, pumping being done at ebb tide.



Remarkable English Motor-Bus

ARTISTIC ARROWHEAD MADE IN RAILROAD SHOP

This beautifully designed arrowhead was conceived and executed by the material supervisor of the San Bernardino

Indian-Head Arrowhead

shops of the Santa Fe Railroad, and was displayed on the machine shop float in the San Bernardino Valley Centennial parade.

MOTOR-BUS HAS A UNIQUE POWER PLANT

This motor-bus, which is now being operated in London, is constructed on a novel system, and has a power plant entirely different from that of any like vehicle. Each driving wheel is propelled independently and directly by worm transmission, and a gasoline engine and electric motor, directly coupled, form each power unit. The gasoline engines are of the 4-cylinder type.

All the suspended parts of the vehicle consist of one steel structure, which greatly increases the strength, while the absence of transmission mechanism underneath gives the bus a big clearance, as the illustration shows.

NEW CHINESE COINAGE

If the latest imperial decree is carried out as expected, China will have a vastly improved coinage system, with coins comparing with the American dollar, half, quarter, dime, nickel and cent, and additional coins worth approximately 2 cents, 5 mills and 1 mill. The standard will be silver and the unit of the national currency will be the "yuan," which corresponds to the American dollar, its value being $1.008.

TRAINING THE STEAMSHIP CAPTAIN OF TOMORROW

SEVERAL of the transatlantic steamship lines, notably the North German Lloyd and the White Star, have special ships on which their future officers are trained for service, and these ships are propelled by sails instead of by steam.

Why the officers of huge steam-driven ships should be trained on comparatively small sailing vessels, instead of upon ships of the type they are intended to navigate, may not be quite clear to the average landsman, so it is well to state that it is because of the lack of opportunities for training them efficiently on the latter. In fact, it is only in the past few years, owing to the ocean-carrying trade having been largely transferred from sailing vessels to steamers, that special training ships have been considered necessary.

The North German Lloyd line has two training ships, "Herzogin Sophie Charlotte," and "Herzogin Cecilia." The former is a four-masted barque of 2,395 tons' carrying capacity, and the latter a four-masted barque of 4,400 tons' capacity. To make the training adequate and thorough, the number of cadets on board either ship at one time is limited to 50.

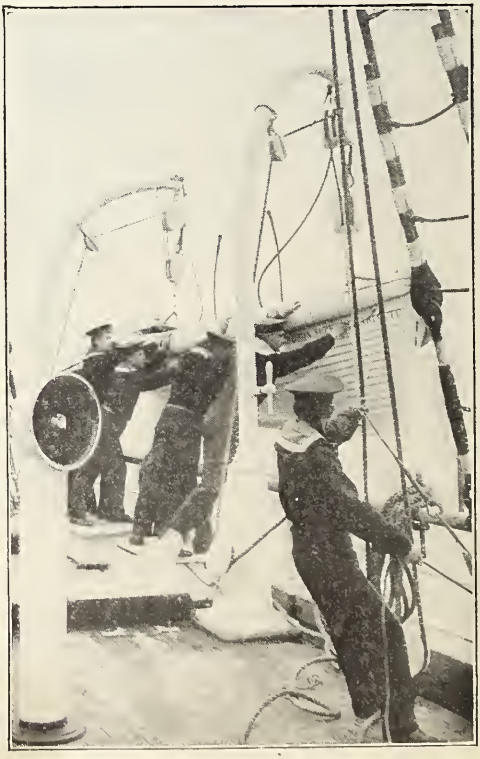
The length of service required of the cadets on these ships is three years, after which they spend a year on one of the regular steamers. This advances them sufficiently to enter the naval school for further preparation for the examination in navigation. When they have obtained their navigation certificate, supposing, of course, that they show themselves generally efficient and competent, they obtain posts as fourth officers on the regular steamers of the line, as far as vacancies allow. They are not, however, under any obligation to take service with the line. After two years further service, a second stay of four or five months at the naval school is necessary to pass the examination in higher navigation, which completes the theoretical studies. The certificate for higher navigation (captain's certificate) gives the right to the independent command of merchant vessels on all seas and waters.

Young Navigators Receiving Instruction at Wheel

The White Star line training ship is the Clyde-built clipper ship "Mersey." Her length is 271 ft., and she registers as 1,829 tons. The cadets are received between 14 and 17 years of age, and are articled for four years. On the expiration of their apprenticeship, they are eligible to pass the Board of Trade examination for second mate's certificate, and on obtaining same are qualified, and have preference for appointment as junior officers on the steamers of the White Star, Leyland, Dominion, and Atlantic Transport lines. Promotion is granted thereafter according to conduct and ability, the intention being that the cadets will remain in the service, passing through the various grades until they become eligible for promotion to senior officers of the watch.

North German Lloyd Training Ship

Part of Graduating Class of "Herzogin Sophie Charlotte"



Merchant Marine Cadets at Lifeboat Drill on Training Ship

In the ship school, the pupils are under a head master. The studies include English grammar, composition, history, geography, arithmetic, algebra, plane and spherical trigonometry, navigation, nautical astronomy, compass deviation, meteorology, marine surveying, drawing, charts, ship construction, and French or German.

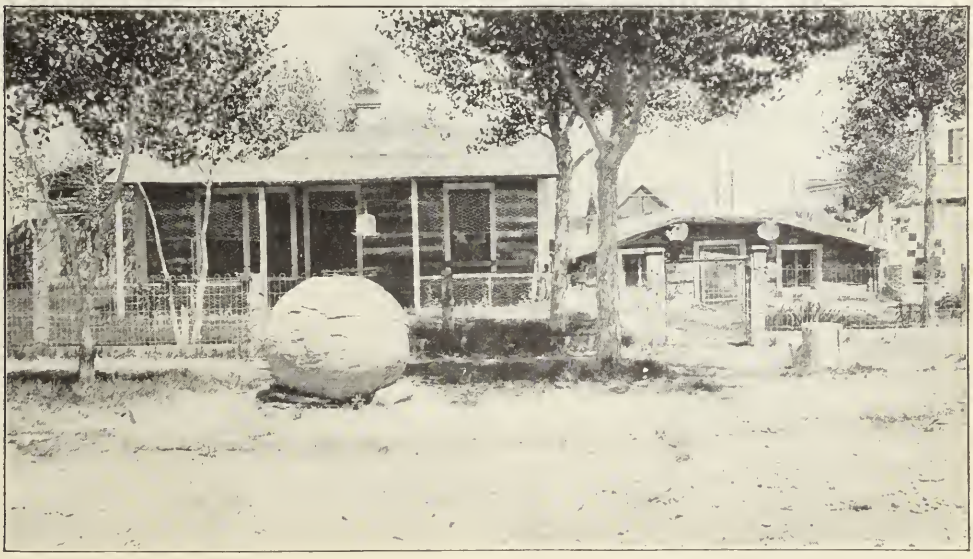
Lectures are given on naval architecture, construction, outfit and measurement of boats, charter parties, keeping of log-books, etc., also on the different qualities of coal, steam raising, and the rudiments of steam engines. The cadets work the ship under the commander and his officers, and in their ordinary duties become familiar with the practical handling of vessels, making and taking in sail, repairing, bending and unbending sails, steering, etc. While in port the cadets are taught swimming, small boat sailing, discharging, receiving, stowage, ventilation and care of cargo, surveying, mooring, and laying out anchors.

Under the head of nautical construction the following subjects are taught: rope knotting, splicing, stropping blocks, moving heavy weights, the use of hand and deep-sea leads, of the patent sounding machine, hand and taffrail logs, compass adjustment, use of sextant, observations of sun and stars, signaling, rule of the road, fog signals, lighthouses and tides.

The cadets are divided into three watches, so that each watch will have eight hours' rest each night, in addition to keeping their four-hour watches on deck, and having four hours in school.

A UNIQUE HITCHING-POST

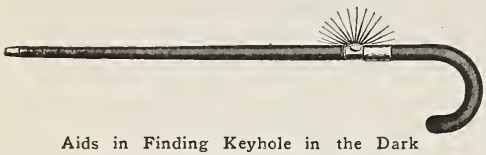
Both the stone and the house shown in this illustration are interesting curiosities. The house was the first built at Basin, Wyoming, and the stone, which has a ring in its top and is used as a hitching-post, was found in exactly its present shape on the bank of the Big Horn River. It is a solid piece of sandstone, measuring about 3 ft. in diameter, and weighing about 2,000 lb.



First House in Basin, Wyoming, and Its Ton Hitching-Post

WALKING STICK WITH ELECTRIC LIGHT

An interesting novelty is a walking stick provided with an electric lamp of the pocket flashlight variety. The possibilities for its use are numerous, as situations continually arise in which illumination is necessary for the moment. Such, for instance, as looking at a watch, or finding the keyhole in the dark.



Aids in Finding Keyhole in the Dark

SMALL SEARCHLIGHT FORTS TO PROTECT BATTLESHIPS

A system of searchlight forts, first tested by the French navy, by which battleships in a roadstead may be encircled by a complete ring of light, is said to have many advantages over the ordinary method of illumination guard in which the ships use their own searchlights.

Warships at anchor in an open harbor offer opportunities for a sudden attack by hostile torpedo boats at night, therefore powerful searchlights are usually utilized to illuminate the surrounding waters. These searchlights, however, give the enemy the exact position of the ships they intend to attack, while the searchlight-fort system forms a ring of light around them, without betraying their exact location.

The searchlight forts are placed sufficiently close together to allow the projecting beams of light to meet, and the light is projected close along the surface of the water, so that there may be no dark patches through which the enemy might slip.

¶A falling bulb of a 40-watt tungsten lamp in the show window of a Chicago store is blamed for setting fire to the dress goods on which it fell.

THE NAVY EXPERIMENTING WITH THE GYROSCOPE

The beneficial results of the installation of the gyroscope on board ships of war have led the Navy Department to purchase one. It has been installed, for purposes of trial and observation, on board the U. S. S. "Birmingham."

The cost of the gyroscope is about $10,000, owing to the fact that it is obtained from German manufacturers. An effort will be made to establish a domestic source of supply, if the gyroscope proves of the practical utility claimed for it. Its use on board the submarines would be of particular advantage, and, with the conditions prevailing on the battleships, it might lead to decided economy in doing away with the non-magnetic metal, which costs so much more than ordinary steel. Gyroscopes have been installed on some of the ships of the German navy.

Following the successful trials of the English and German gyroscope monorail cars, a Russian has announced the completion of such a car, driven by steam instead of gasoline. The inventor is the governor of Kostroma, and his work is said to be the result of many years of study and experiment. Among the special features of his monorail car are a device that automatically corrects all oscillation, and a gyroscope that can be run at a speed of 800 revolutions per minute, instead of several thousand, and does not require a vacuum, as do the English and German inventions. It is also said that no particular perfection of workmanship is required.

Other recent developments in monorail cars are a truck, which converts vertical and horizontal oscillations into oscillations all in one plane, and a coupling, which keeps trailers perfectly upright as long as they are attached to the gyroscope car, but which allows perfect freedom in running up or down gradients and around curves.

¶Milwaukee has adopted the thumbprint system of identification as a check against forgery in the payment of city employes.

Inclosed Tennis Court on Astor Estate and the Swimming Pool

A MILLIONAIRE'S GAME BUILDING

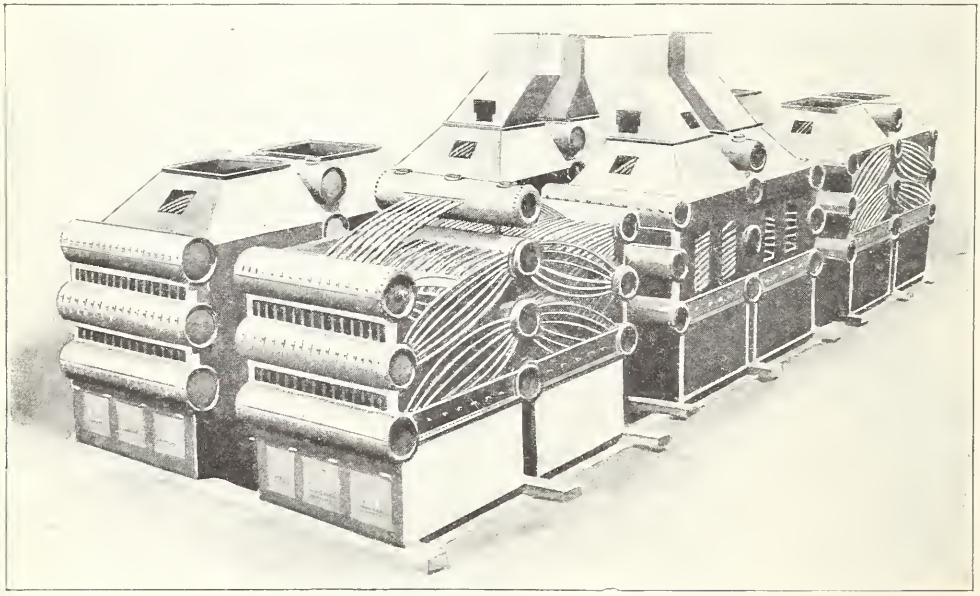
One of the finest examples of private buildings constructed for the indoor playing of tennis and squash is to be found on the estate of John Jacob Astor at Rhinebeck, N. Y.

The building is T-shaped, with a tennis court occupying the long member of the "T." Dressing rooms form one side of the head, and the other side is formed by a squash court, swimming

pool, and men's dressing room. In addition to these is still another squash court on the main floor, a large reception hall, a number of bed chambers, and a living room. On the basement floor are still more bedrooms, a kitchen, and other departments.

The clay floor of the tennis court is the result of a considerable amount of study in order to get the quality of earth which would withstand conditions under a glass roof.

The outer walls of the building are constructed of stuccoed brick, the foundation is of rubble stone, and the roof is slate.



Japanese Marine Boilers without Flat Surfaces

WATER-TUBE BOILERS OF JAPANESE CRUISER

The marine water-tube boilers used in the majority of Japanese warships are built without flat or stayed surfaces, the entire boiler consisting of drums and curved tubes. Due to the arrangement of the nests of tubes, it is very elastic and accommodates itself to the changes due to expansion and contraction.

This type of boiler is claimed to be the only one used in the entire Japanese navy which can be kept under steam for six months without cleaning the inside. The boilers in the illustration are for the Japanese cruiser "Mogami."

UNITED STATES EXPLOSIVE MOST POWERFUL IN WORLD

That the United States army has the most powerful explosive and most perfect type of gun in the world was made known recently by General Frederick Dent Grant, commander of the Department of the East.

"Why, we've had the most powerful explosive of modern times for more than a dozen years waiting for guns strong enough to shoot it," says General Grant, "but nobody could devise the gun. Well, we've got the gun now, and we're using the explosive in it. I have just looked the new gun over and it is the most perfect in the world this minute."

¶ The importations of precious stones in the United States in the last fiscal year were $44,885,057, several millions higher than the previous record year, 1906.

Will Store 650,000,000 Gal. Water

Will Wipe Out Five Existing Settlements

The Ten-Million-Dollar Irrigation Project in New Mexico

By

L. WILLIAM THAVIS

Will Also Irrigate Land in Old Mexico

Will Inundate 180 Square Miles of Territory

HAVING just completed the Roosevelt dam of the Salt River irrigation project in Arizona, the greatest engineering feat of the age, at a cost of nearly $9,000,000, Uncle Sam will now turn his attention toward the construction of a similar project in New Mexico. It will be a great reservoir at Engle, connecting two diversion dams, one located at Leasburg, and the other 120 miles north of El Paso, Tex.

The Engle reservoir and its diversion dams are intended to harness the waters of the Rio Grande River and be of far greater magnitude than the Assuan dam of the Nile River, Egypt, now reputed the greatest irrigation project in the world. The Engle reservoir alone will hold twice as much water as the Nile River project, will be 40 miles in length, and reach an average width of nearly four miles, varying from three to six miles. In it will be stored approximately 650,000,000 gal. or 2,000,000 acre-feet of water. The entire flow of the Rio Grande for three years will be required to fill the reservoir. The cost of the Engle dam will reach far more than $10,000,000 when completed.

The construction of the Engle reservoir will wipe out five settlements, besides inundating about 180 square miles of territory in New Mexico. While this general basin and its two diversion dams are located in New Mexico, the

Looking Up the Rio Grande River through the Dam Site—Dotted Lines Show Immensity of Dam Which Will Be Built

lands to be irrigated lie partly in New Mexico, partly in Texas and partly in the Republic of Mexico.

The main dam construction work of the Engle reservoir will be 1,200 ft. in length at its crest and about 20 ft. in thickness. Its greatest height will be 275 ft. above the bed of the river. Reinforced concrete will be employed throughout.

Until a railroad 15 miles in length is built, little work can be done on the dam, for the reason that most of the machinery to be used is too heavy to be moved by any other method than on rails. Moreover, a small army of men must be supplied with the necessaries of life for two or possibly three years, and this alone would be a great undertaking, should it have to be done over the ordinary road. At present 150 men are employed at Engle, but this force will be augmented to about 2,000, as soon as work on the dam commences in real earnest next spring.

The construction of the Engle dam will involve the following general features: building of the branch railroad; construction of plant, quarters and other buildings and accessories; building of the main flume and cofferdams; excavation of the sluicing tunnel; excavation in the river bed and for the abutments; making and placing the masonry of the dam; construction of the power station and transmission lines; building an embankment at the gap in the hills northwest of the dam; permanent buildings, roads, etc.

A large portion of the Engle dam contract will involve the excavation of the river bed and the preparation of the foundation at a distance of 60 to 80 ft. below the normal river bed. This will not only be hazardous work, but its extent and character can not be predicted. The foundation has been carefully sounded with diamond drills, but, nevertheless, experience shows that unexpected conditions are likely to develop and plans must be changed from time to time in the preparation of foundation.

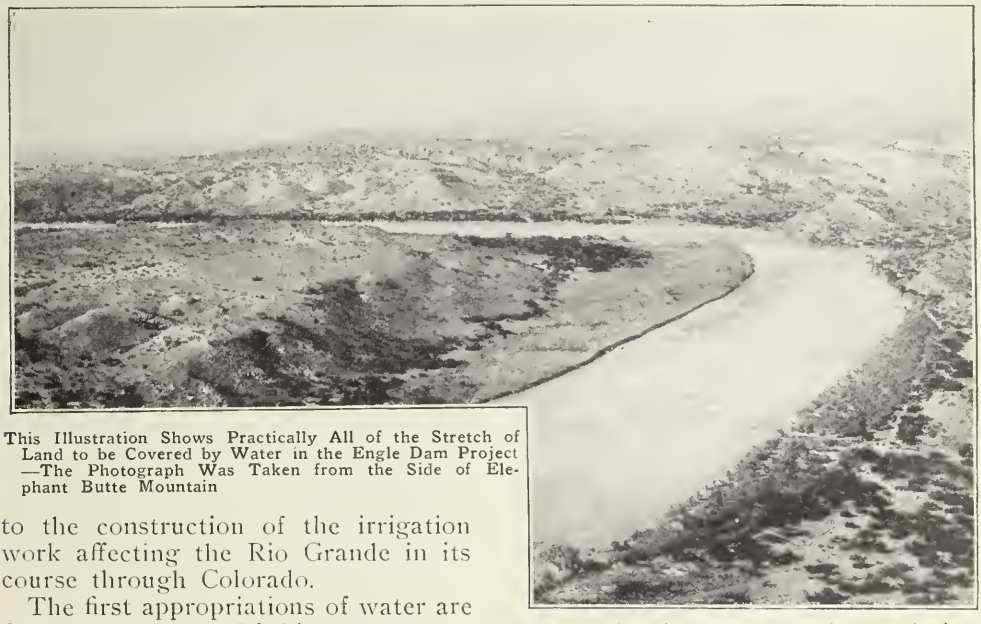
The Rio Grande project lies in central and southern New Mexico and Texas. The source of water supply is the watershed of the Rio Grande, which takes its rise in central Colorado and flows southward through the middle of New Mexico, so far as El Paso, Tex., whence it becomes the boundary between the United States and Old Mexico, until it empties into the Gulf of Mexico. The Rio Grande is formed by numerous streams, which flow into it from the high mountains of Colorado and New Mexico, and the plan is to construct a reservoir of sufficient size to store all of the rainfall of three years on this vast watershed.

In its course the river flows through large areas of forest, and in the mountains outlying are rich deposits of gold, silver, copper, lead and coal. Occasionally, the course of the stream lies through wide plains. North of El Paso, the valley of the stream is bound by rugged mountains, near or remote and here, in southern New Mexico and Texas, are the areas which the project is designed to irrigate.

The Leasburg diversion dam already has been completed, and water has been diverted into canals by it, since the spring of 1908. This water is sufficient for about 25,000 acres of Mesilla Valley, and 13,000 acres more of that valley are irrigated by the community plan. The Leasburg dam takes the place of two former community headings. Above the Leasburg dam, about 5,000 acres of Rincon Valley are watered by community canals. The same system is employed in El Paso Valley.

It will be possible to irrigate from the Engle reservoir several millions acres of very fine valley land suited to the cultivation of practically every crop. The dam will also prevent the heavy spring floods, which in the past have caused a great deal of anxiety and damage along the Rio Grande River each year.

Before the project could be carried out, an agreement had to be reached between this country and Old Mexico. By its terms the United States gives to farmers along the Mexican bank of the river as much water as they used prior

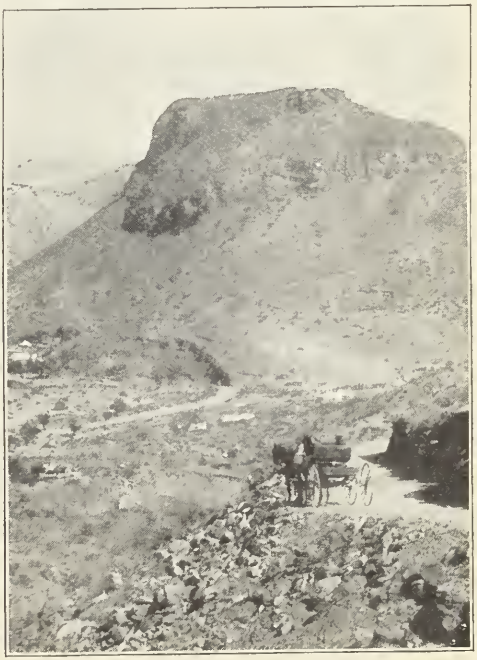


This Illustration Shows Practically All of the Stretch of Land to be Covered by Water in the Engle Dam Project —The Photograph Was Taken from the Side of Elephant Butte Mountain

to the construction of the irrigation work affecting the Rio Grande in its course through Colorado.

The first appropriations of water are for 180,000 acres. Of this, 25,000 acres lie in Old Mexico, and the remainder in New Mexico and Texas. The United States reclamation service promises water for no more than 180,000 acres, but the local water users' association expects that there will be enough for 200,000 acres. Of this area 110,000 acres lie in New Mexico, 45,000 acres in Texas, and 23,000 in Old Mexico.

Looking Down into Elephant Butte Valley on Camp of Workmen Engaged in the Work of Building the Huge Dam



Elephant Butte Mountain, Below Site of Dam— —Crest Gives Impression of Elephant Lying Down, with Head to Left

By a treaty between that Republic and the United States in settlement of claims on account of prior rights to the waters of the Rio Grande, the United States agrees to deliver at the border, for these 25,000 acres, 60,000 acre-feet a year. For this, Congress has appropriated directly from the treasury the sum of $1,000,000. The rest of the lands, 156,000 acres, pay the government for the project in ten annual installments. By the terms of the reclamation act, no person may have water for more than 160 acres, but he must pay the annual installments for all the land he may own. This means that a person who may own more than 160 acres will have to sell it.

In regard to the interest of the water users under the Rio Grande project, who will eventually have to pay the major part of the cost of construction of the dam, the time required in its construction is a very important item. It has been conservatively estimated that the value of the Engle reservoir to them will be equal to the net profit on the use of 100,000 acres of land now producing nothing, which the reservoir will make it possible to cultivate. Even though the whole of this land would not be immediately put in cultivation, the time when it will be all in cultivation would be brought one year nearer by each year saved in constructing the dam. The net profit on this land in alfalfa alone, at present prices, would be at least $25 per acre, or $2,500,000 per annum on the whole acreage.

The history of the Rio Grande Valley is the history of New Mexico. Before the advent of the Spaniards under Marco de Niza, in 1539, this territory had been the home for untold generations of sedentary tribes of Indians, as well as nomadic predatory tribes. Many ruined pueblos and houses of stone in the shelves of the rocky cliffs attest to this period of settlement. Following Niza, and guided by him, Francisco Vasquez Coronado came to this country in 1540, and used the valley of the Rio Grande as a base for his explorations into what is now Arizona, Texas and Kansas, the Grand Canyon of the Colorado, one of the wonders of the world, having been discovered in one of these expeditions. From this time on, the history of this valley is one of conquest and revolt, the Indians not being entirely overcome until the close of the seventeenth century.

Thenceforward New Mexico grew in importance, new towns being established in the Rio Grande Valley, where the colonists learned to make use of the crude but often extensive irrigation works that had been established, probably centuries before, by the aboriginal inhabitants. Early in the nineteenth century a considerable trade sprang up with the settlements along the American frontier, notably Kaskaskia in Illinois, and Franklin and Independence in Missouri. This was the beginning of the overland commerce over the famous Santa Fe trail, and was, in fact, the cause of its existence, the trail being abandoned when the Santa Fe Railway entered the territory, in 1880.

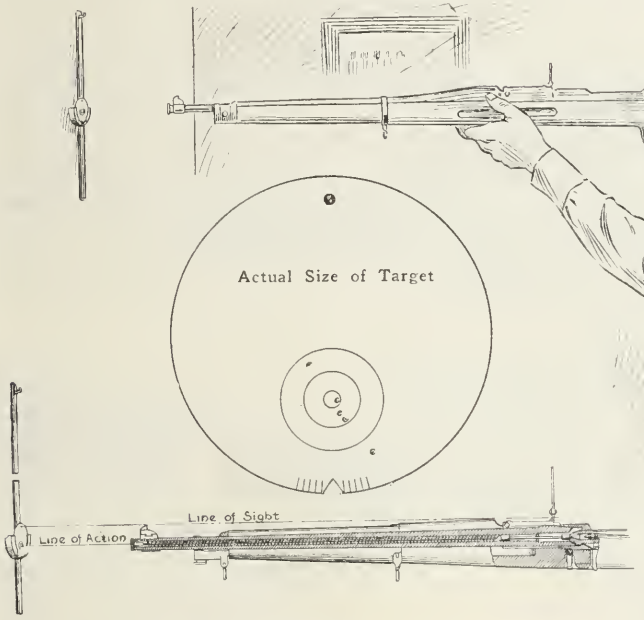
MARKSMANSHIP OF SOLDIERS IMPROVED BY USE OF PIN PROJECTILE

A new and ingenious means of improving the marksmanship of soldiers has been adopted by the U. S. army, air pressure and a pin projectile being substituted in the ordinary army rifle for cartridges, thus eliminating noise and danger. A rod, fitted into the gun barrel, is driven forward by a spring, sending the hammer home after the fashion of the air-gun, and a sharp pin projection on the end registers a dent in the target. This target is a miniature affair made of cardboard, about 2 in. in diameter, on which are circles

surrounding a small bullseye. The target is slipped into a piece of grooved tin, mounted on a rubber pad an inch thick, which is supported by a pendulum-like rod. It may be suspended on ordinary boards hung on the wall of a room or porch.

WORKING LIFE OF BIG GUNS ONLY FOUR SECONDS

The average person, if asked the actual working life of big guns, would probably give a guess in at least days or weeks, if not in months, and would



Spring Arrangement in Barrel

Target Practice Indoors

The instructions given by the department for the use of the device are as follows: The target should be set about level with the eye, with notch in edge engaging point at bottom of holder. Set rifle sights for 200 yd. and aim at upper spot on sub-target, holding muzzle of rifle about 8 in. from target. Snapping the bolt drives pin out from the barrel and scores a record. The target may be turned either way in holder, bringing any of the graduations adjacent to the point to allow for error in eyesight. These graduations correspond to the windage on rifle sight.

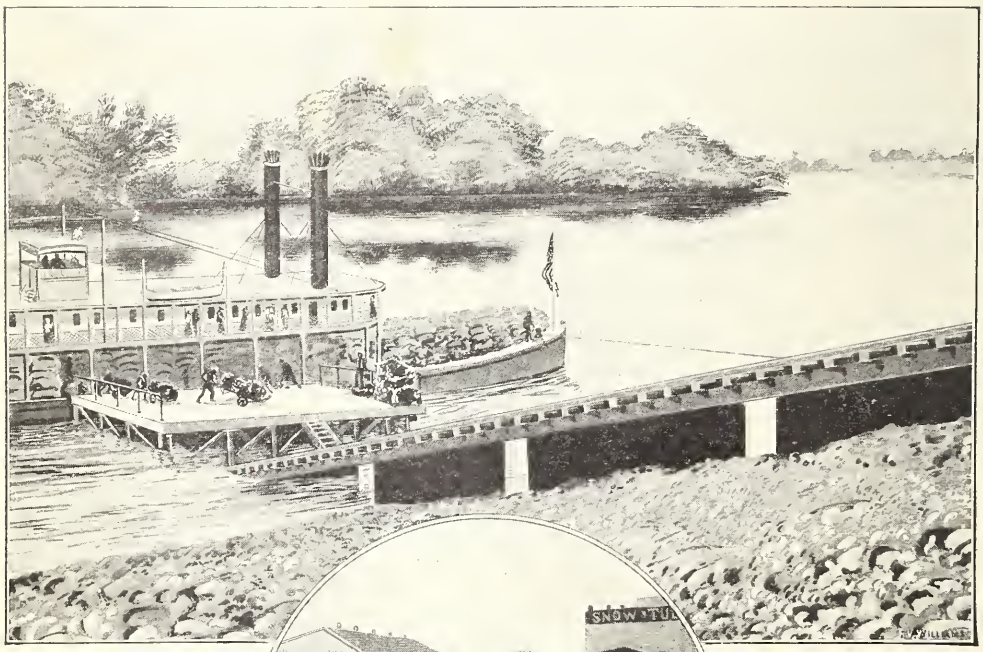
Tests made by the army experts show that the system will perfect marksmanship almost as well as the regular target practice, and it has the further advantage that it can be used by the soldiers at any time or in any place.

be dumbfounded if told that the average is only four seconds. Yet this is a fact when you figure the actual working life as the time in which the projectiles are passing through the guns.

A 12-in. gun is destroyed by erosion of the bore after 100 projectiles have been fired, the erosion commencing with the first shot and gradually impairing the power of the gun until the end. The average mean velocity of the projectile is half the muzzle velocity, or about 1,200 ft. per second. The length of the gun is 45 ft., which means that 26 projectiles traveling 1,200 ft. per second only take one second to pass through the gun. At this rate, 104 projectiles could pass through in four seconds' actual time, while the life of such a gun is only 100 projectiles as above stated.

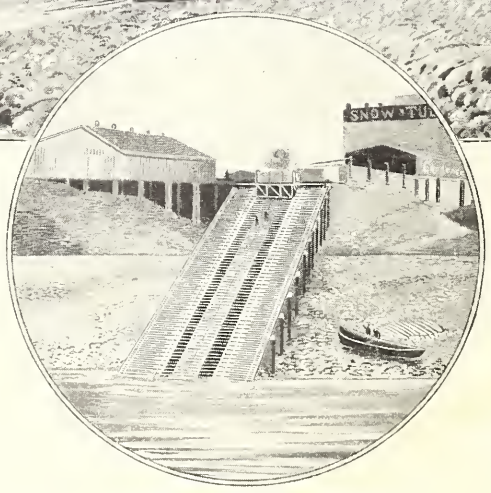
ADJUSTABLE INCLINED UNLOADING WHARF

The city engineer of Montgomery, Ala., has devised a unique wharf for use on rivers subject to great variations. The arrangement was adopted by the city of Montgomery, and is now in active and successful operation.



Movable Wharf in Position

It consists of a double railway-track incline, set on concrete piers, and leading from a warehouse on the bank of the river to the lowest water level. On the double track is a movable wharf, so mounted that its platform is level. This platform is lowered or raised with the rise and fall of the water, so that the river boats may lie alongside and load or unload at all stages.



Incline Tracks of Movable Wharf

On the same incline, operating independently of each other, are two electrically-controlled cars which are used to transport the cargo being loaded or unloaded from the warehouse to the movable wharf.

The water level of the Alabama River varies many feet during the year, and a fixed dock that would be available at one time might be 15 or 20 ft. above or below water level at other times, causing loss of time and money.

¶The "colonial" style of interior decoration is to form the principal scheme of the finish for the new Cunard liner "Franconia," launched in July at Walsend, England.

LUBRICATION PRESERVES WIRE ROPE

Lack of proper lubrication is the greatest cause of disintegration of wire rope. The corrosion is particularly noticeable on the inside wires of the strands, due to the fact that the lubrication has failed to penetrate to them.

The scientific lubrication of wire rope, according to the American Wire Rope News, is a matter which has not been given the attention it deserves. A wire rope is very complex, requiring constant lubrication not only on the surface, but inside of the strands. Many wire ropes fail because of the complete corrosion of the inside wires, while the outside wires are apparently in good condition.

THE AEROPLANE CAMERA

Several types of cameras are now being made especially for the purpose of taking snapshots from, and of, aerial craft. The machine illustrated is one of the best examples. For use in the air it is mounted on the frame of an aeroplane in such a position that the second man in the machine may focus it on the country underneath. When used on the ground, it rests upon a tripod and is aimed at the object in the air in very much the same way as a rapid-fire gun.

Photographing an Aeroplane with the Camera

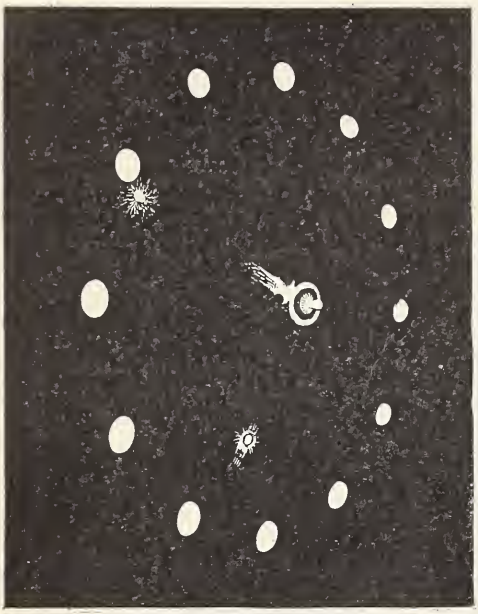
Mounted on an Aeroplane

LARGEST GOLD-ORE CRUSHING BATTERY IN WORLD

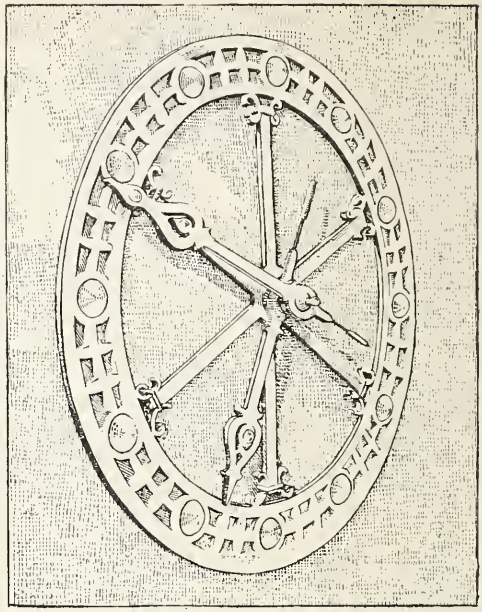
The great gold-ore crushing plant recently erected in the Transvaal, Africa, is said to be by far the largest in the world. The battery contains no less than 600 stamps, each with a falling weight of 1,650 lb. The length of the structure housing the plant is 634 ft.; the width, 69 ft.; and the height, 62 ft. Thirty motors are required to drive the stamps.

The mortar blocks rest on a mat of bitumastic concrete, the object of this being to dampen the vibrations, which would otherwise be transmitted direct to the surrounding ground. The bins, which are constructed of pitch pine and lined with steel sheeting, have a capacity of 13,000 tons of rock.

The mill is in the Witwater sand district, which is said to be the greatest gold-producing center in the world at the present time.



The Illumination at Night

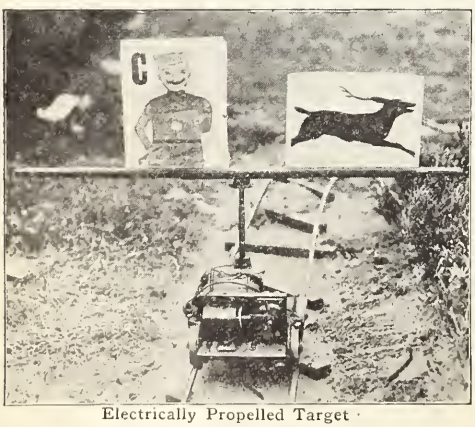


Appearance of the Clock by Day

AUTOMATIC ELECTRIC TARGET FOR SHARP-SHOOTERS

An interesting mechanical device used at the recent great rifle meet at Bisley, England, in which the Empire and Freemantle cup contests were the drawing cards, was the automatic electric target shown in the illustration.

It consists of an electric truck on which are mounted the figures of a



Electrically Propelled Target

soldier and a deer. The truck runs on a narrow track which curves in and out, thus continually changing the distance.

MONSTER CLOCK WITH ELECTRIC DISK DIALS

The mammoth electric clock erected in the tower of the Federal building at Newbern, N. C., has several unique features, the most interesting of which is the arrangement of the dials, which are without numerals to indicate the hours. Instead they have 12 opalescent glass disks, which will show white in the daytime, and will be illuminated at night. Back of each disk is an electric lamp, backed by an aluminum reflector. There are openings behind each dial to permit the renewing of the lamps, and the dials may be revolved to bring the several lights in front of the openings, so that they may be reached. These are said to be the first dials ever made so that they can be revolved.

The framework of the dials is of wrought-iron construction, with cast-metal circles to hold the disks. The hands are made of cast aluminum, with an electric light at the hub, and one near the point of each hand. These lights show red to distinguish them from the dial lights.

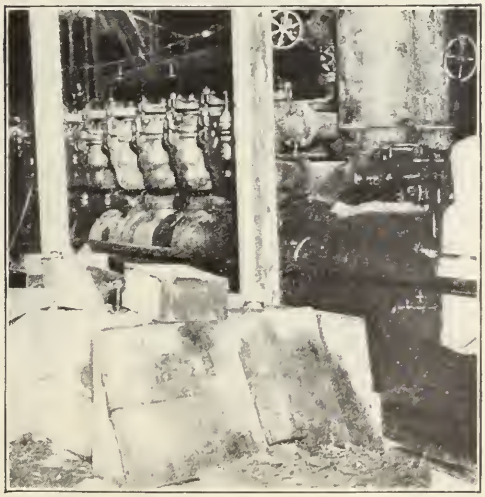
SPECIAL TELEPHONE DEVICE AS ARMY SCOUT

Considerable interest was evinced in recent maneuvers of the National Guard in the utilization of telephone wires provided with special sound-magnifying transmitters as a means of determining the strength and movements of the enemy.

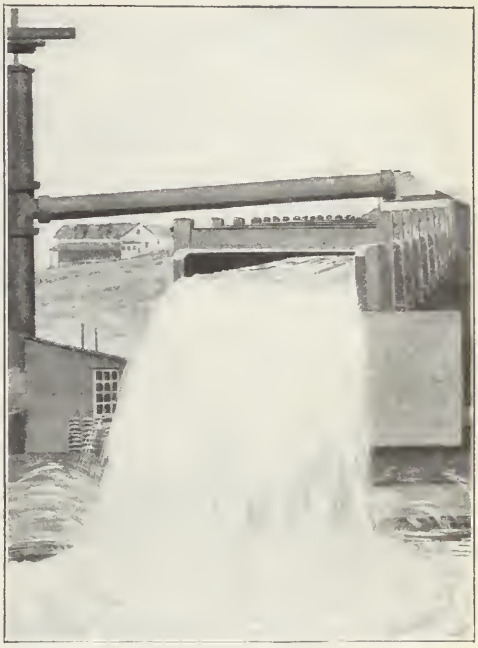
In the experiments, the transmitters were concealed along the roads over which the troops representing the enemy might be expected to pass, and concealed wires were used to connect them with signal corps stations. In this way the sound of the approaching troops could be heard at a distance, and their strength determined by the period of time they could be heard marching past.

PUMPING OUT A SUBMERGED MINE

The fall of water shown in one of the accompanying illustrations is pumped from the Tombstone Consolidated mines in Arizona, which were flooded by a breakdown of the pumps at the 1,000-ft. level. Between 6,000,000 and 7,000,000 gal. are pumped from the mines every day, which would be more than enough to supply the town of Tombstone and irrigate the nearby truck farms and orchards. The pumps which failed and are now under water are shown in the other illustration.



The Pumps That Failed

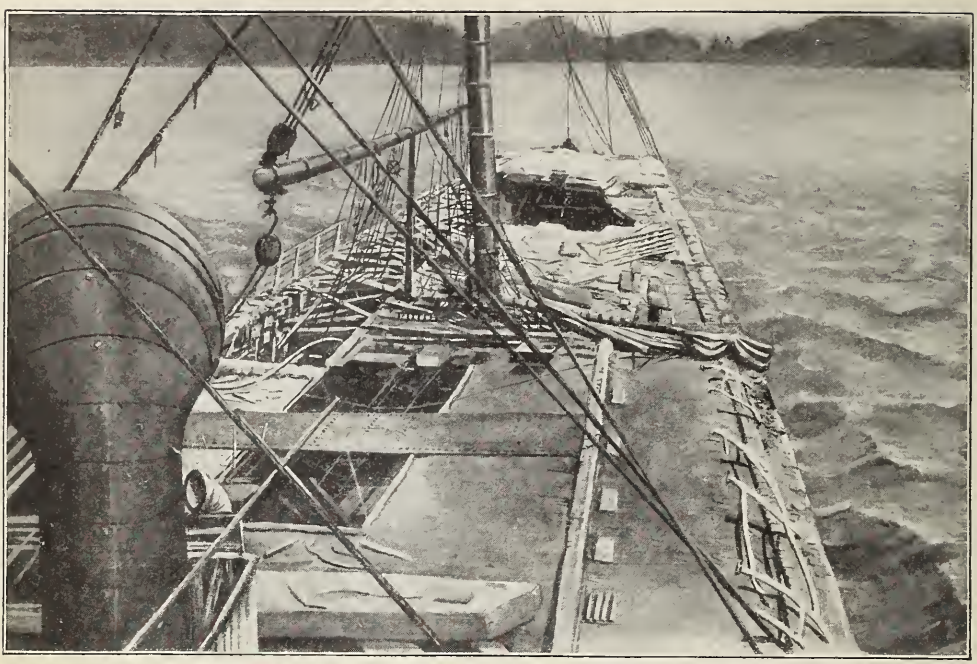


Great Volume of Water from Flooded Mine

The gold, silver and copper mines in Cochise County, Arizona, are continually threatened after a depth of 500 ft. has been reached, by underground lakes and springs. The pumps have to throw out immense volumes of water, and when a breakdown occurs the result is very likely to be serious.

NEW STEEL ALLOY USED FOR TELEPHONE DIAPHRAGMS

A new steel alloy metal is being so successfully used for telephone equipment in England that several of the telephone companies in this country are now testing it for receiver diaphragms. It is called "stalloy," and its chief characteristic is that the addition of three per cent silicon increases the resistance of the alloy to about three and one-half times that of the ordinary transformer iron, so that the eddy current, when it is used as part of the alternating current magnetic circuit, is greatly reduced.



Damage Caused by Ice Floes

SALVING A VESSEL IN ICE FLOES

One of the most exceptional cases of salving in the records of Pacific Coast shipping was recently carried to a successful conclusion in the raising of the S. S. "Yucatan," a 336-ft. steel steamer, wrecked in Icy Straits, off the coast of Alaska, last February.

The salvage steamer "Santa Cruz" reached the wreck on Feb. 19, but was unable to get alongside because of the ice. Boat crews dodged in and out whenever the ice receded with the tide sufficiently to give them an opportunity to work, and by this continual fight with the ice, the vessel was prepared for raising. For a period of two weeks, the salvors made "hurry up" rushes at the job, working a couple of hours at a time, and then being driven back by the ice. Divers who went down from the steamer's boats had many narrow escapes, the floating ice often threatening to interrupt their air supply. During March and the early part of April, the divers were continually working under the ice, while boat crews fought to keep the floes at a safe distance from the air hose.

Ice played havoc with the wrecked vessel, completely covering the after part, and carrying away the deckhouses. The stern was stove in and the deck frames crushed out of shape, while surging ice soon gutted the after part from the engine room casing aft.

EXTENT AND KIND OF TRAVEL ON MASSACHUSETTS ROADS

A traffic census conducted by the Massachusetts Highway Commission on the 740 miles of state roads, to determine the relative importance of the different routes of travel and the number and type of vehicles passing over them, gave the following results:

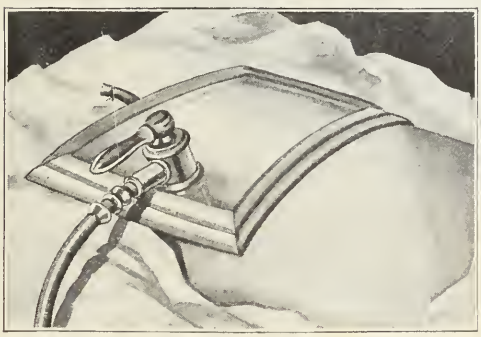
The census was taken during one month from 237 stations or points of vantage. The number of light horse-drawn vehicles, which means a buggy,

carryall, democrat wagon, etc., used for pleasure or light business purposes, recorded was 19,622. The heavy horse-drawn vehicles reached a total of 17,969, while the number of automobile touring cars recorded was 21,387, and the runabouts, 5,922. This gives a total of 64,900 vehicles seen and recorded from the 237 stations.

PNEUMATIC SHIELD FOR OPERATIONS ON THE LUNGS

In operations on the chest, either pleural cavity, and even the partition between them, as a rule, may be invaded without causing death, but it is a satisfaction, according to a writer in the Journal of the American Medical Association, to have an apparatus handy that is capable of almost instantly removing the condition of pneumothorax (air or other gas present in the chest cavity).

Such an apparatus is here illustrated. It is an aspirating shield, a simple inflated rubber rim, in which is held a flexible celluloid window. A two-way cock connects the cavity of the shield, at will, with either the external air or a vacuum tank. To overcome pneumothorax, the shield is applied over the wound and the lever turned connecting the vacuum tank with the cavity of the



Pneumatic Shield as Aid in Lung Operations

shield. A form of artificial respiration may be produced by alternately producing and relieving the pressure in the cavity.

FRENCH DESTROYER WITH TURBINES AND RECIPROCATING ENGINE

This French torpedo-boat destroyer, with its peculiar-appearing stern and

Peculiar Hull of French Destroyer "Voltiguer"

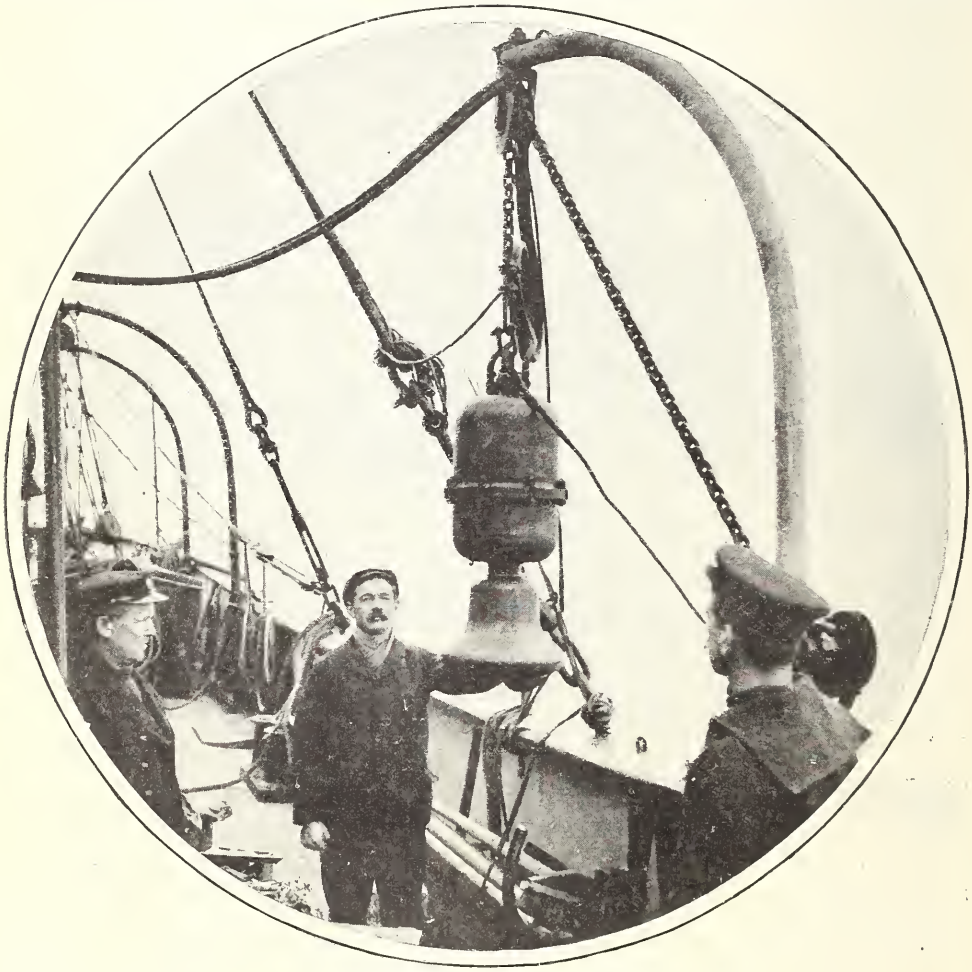
its arrangement of propellers, is driven by a very interesting arrangement of turbines and an engine of the reciprocating type. On each shaft is a high pressure turbine mounted on wheels, with a low-pressure turbine mounted on the drum. The steam is admitted into the turbines at several points, lowest speed is given by longest expansion, and variations in speed are obtained by opening different valves and a single steam-cock.

The reciprocating engine is used for cruising speed, and drives the central propeller. When running at low speed this engine and the turbines are connected, the steam, after expanding in the reciprocating engine, being delivered into the turbines. The most economical power is thus obtained at speeds up to 23 miles an hour, above which each engine works separately.

¶Laundry tubs are now made of cement, which is stronger than the stone used for that purpose. If broken, they can be mended.

SIGNALING UNDER THE SEA

One of the submarine signal bells with which British lightships are provided is here illustrated. It is on the Tongue lightship and when rung conveys a warning beneath the waves to all vessels fitted with the required receiving apparatus.



Bell That Rings Out Under Water

NEW GAS FOR NON-DIRIGIBLE BALLOONS

An interesting new method of preparing gas for non-dirigible balloons has been adopted at Chemnitz, Germany. It consists of forcing illuminating gas through long tubes, maintained at a high temperature. Most of the carbon in the hydrocarbons is separated by this means, and the percentage of hydrogen is largely increased. At the same time, the gas is deprived almost entirely of the characteristic odor and also freed from the presence of benzine, which exerts an undesirable solvent action upon the materials employed to render balloons impermeable.

A balloon with a capacity of 7,000 cu. ft., when inflated with this gas, is said to have a lifting power equal to that of a balloon of 10,000 cu. ft., charged with ordinary coal gas.

HEAT

Part IX—Energy and Fuels

By J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the eighth article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. The following subjects were discussed in the months indicated; February, "The Nature of Heat and How It Is Measured;" March, "How Low Temperatures Are Produced;" April, "Some Effects of Low Temperature Upon Matter;" May, "The Production and Uses of High Temperature;" June, "High Temperatures and the Rare Metals;" July, "How Heat Travels;" August, "How Heat Is Measured;" September, "Expansion and Contraction." Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

THE fairy tale of yesterday is the science of today.

In our wide-eyed childhood days we pored eagerly over the wonder stories of the Brothers Grimm, or listened with awed attention to the prodigies and marvelous deeds of Baron Munchausen and Sindbad the Sailor. Well do we remember the man by the wayside who refused to doff his hat as by doing so a killing frost would blight everything in his vicinity; likewise do we call to mind that other happy individual, the fortunate owner of the famous seven-league boots, who was able to walk comfortably around the earth in a single day.

All these wonderful tales sink into insignificance beside the simple facts of modern science. A few turns of wire whirling in front of a magnet, and lo! we have a light that rivals the sun in its intensity, or a silent power that turns all the wheels in our factories. A whisper in New York may be heard in Chicago. The President of the United States touches a button in Washington and ponderous machinery is energized in the far off Philippines.

A steamship far out at sea flashes "C Q D" into the murky fog of the night; instantly sister ships, scores of miles across the horizon, respond and turn their prows in her direction. A few buckets of water confined within an iron box will carry a heavy locomotive and its train of Pullmans 60 miles an hour. A few pounds of piano wire and a dozen yards of muslin enable us to go sight seeing into the very air itself, outwinging the birds in swiftness of flight. A few tiny bits of curved glass tell us the exact composition of suns and stars billions of miles away in the vast expanse of the heavens.

Whether it be electricity, magnetism, steam, wood, coal, oil or gas that is the direct agent in the production of power,

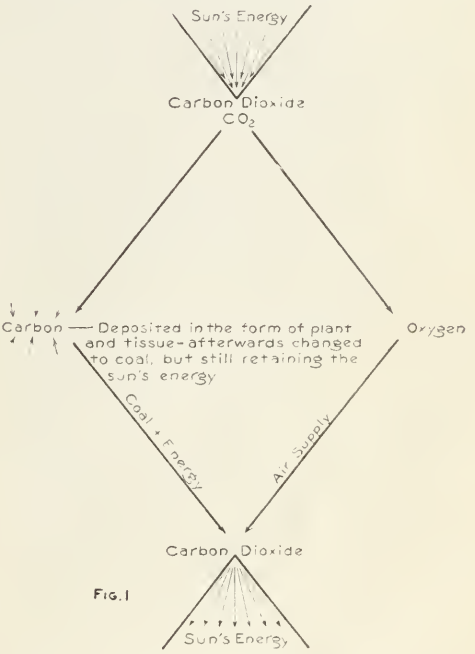


FIG. 1

Diagram Showing the Storing of Energy in Coal, and its Release in After Ages by the Addition of Oxygen

it is the sun, after all, that is the source of all the energy in the world. For ages and ages the sun has been bathing the earth with her radiant energy, and storing up for us in mighty caverns enormous supplies of energy in the form of coal, oil and gas. To look at a bit of coal, grimy and stony in appearance, one would hardly suspect that it is practically preserved sunlight and heat. Let us look a little into this matter of coal, and attempt to account for its wonderful properties, and learn just how it received its fuel power.

First of all we must bear in mind that

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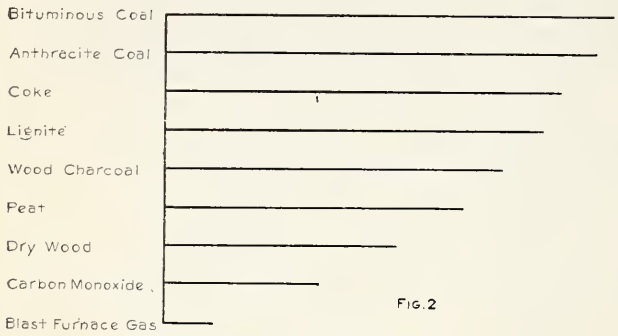
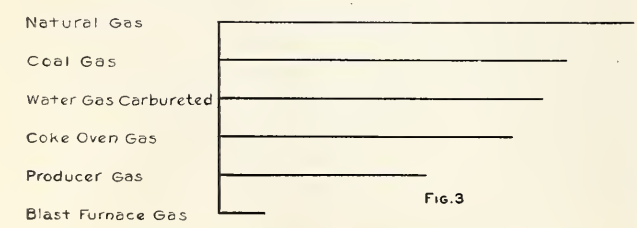
even as matter is indestructible, so is that strange and mysterious something known as energy. Even as there is just as much matter in the universe today as there was in the beginning, there is just as much energy. No energy is ever lost except in a practical sense. The stones that were carried to the very pinnacle of the Great Pyramid, retain to this day the energy of position, given to them ages ago by workmen who have long since turned to the dust whence they sprang. The Washington monument is not only a memorial to America's greatest citizen but it is also a storehouse of work done.



Relative Values of Various Fuels

Coal was formed from plants that flourished millions of years ago and which were prevented from oxidation by the fact that they fell into swamps and morasses and were covered with a protective layer of water. Afterwards they were entombed under billions of tons of sandstone, limestone and clay. The resulting pressure and heat caused the vegetable matter to assume the form of coal in which state it is familiar to us. Clearly it was not the water, nor the pressure that gave the coal its store of energy. It must have received it while it was still a member of the plant world. Wood will burn. Grass will burn. Corn will burn. All plants will burn. Coal was formed from plants.

Evidently plants are the storehouses of energy. How do they get it? In this way: A plant cell is a chemical laboratory whose secrets have been, and still are, the envy of every chemist. When the sunlight aids it, a plant has the power of chemically combining water with a gas known as carbonic oxide, the same gas that is given off by animals in breathing. The product of this composition is known as starch, cellulose, or woody tissue. While the plant is able to form the actual combination of gas and water, it is the sun's energy after all that gives it the power to do so. The sun does the actual work, using some of its own energy in the operation. To raise a pound one foot, requires one foot-pound of energy. To do any kind of work, physical or chemical, requires energy which may be stated in terms of foot-pounds.



Relative Fuel Values of Several Gases

The energy of the sun in helping the plant in its work of chemical combination, is just as much work and of practically the same kind as that put forth by a laborer in carrying a hod of bricks up a ladder. And even as the energy used by the laborer remains at the top of the ladder, so does the energy used by the sun remain within the wood built up by the plant and the sun. When the wood, or what is the same thing, the coal, is placed under proper conditions, namely, sufficient heat and abundance of air supply, the wood returns to its original components, water and carbonic oxide gas, and the sun's energy that has been imprisoned within the wood or coal is set free in the form

of heat, the lowest form of energy. Look at the diagram shown in Fig. 1, and the simple changes and transformations will be readily understood. As is the story of wood and its wonderful power of locking up energy, so is the story of oil, of natural gas, of producer gas, of illuminating gas and of every other fuel known to man. Directly or indirectly they are children of the sun, and it is the sun's energy that is given back by them to man. There are many different kinds of coal, varying from peat which is the first station on the way to the kingdom of coal, up to anthracite, which is almost pure carbon, having lost almost every other constituent. The value of coal is estimated principally by the number of heat units it can give off. Let us recall right here just what a heat unit is. A British thermal unit, abbreviated B. t. u., is the amount of heat required to raise a pound of water through one Fahrenheit degree. The table given herewith, compiled from the Practical Engineer, shows the relative heating values of the different coal fuels.

HEAT VALUE OF VARIOUS FUELS AND COMPOSITION

Name of Combustible	Composition C	H	Volatile Matter	Ash	Caloric Power B.t.u.
Carbon	1.00	....	....	....	.....
Anthracite Coal	0.90	0.03	0.03	0.01	13500
Bituminous Coal	0.85	0.05	0.06	0.06	14400
Lignite	0.70	0.05	0.20	0.05	11700
Peat	0.55	0.05	0.30	0.10	9000
Peat 0.20 water	0.39	0.04	0.50	0.07	7200
Coke	0.85	0.05	....	0.10	12600
Peat-charcoal	0.82	....	....	0.18	9000
Dry wood	0.48	0.06	0.05	0.01	7200
Wood 0.20 water	0.40	0.05	0.25	0.01	5400
Wood-charcoal	0.80	....	0.04	0.07	10800
Hydrogen	....	1.00	....	....	62000
Carbonic oxide	0.43	....	0.57	....	4320
Illuminating gas	0.62	0.21	0.17	....	18000
Blast-furnace gas	0.06	0.02	0.92	....	1620

It will be observed from this table that the value in heat units of coal or other fuel depends practically upon its percentage of carbon. Anthracite has the largest percentage of carbon, but does not give off the greatest number of heat units, being a little behind bituminous coal in that respect; the gas from a blast furnace has the lowest quantity of carbon, and gives the least number of heat units.

The size of coal used in a furnace has a great deal to do with its efficiency as a heat producer, and manufacturers are giving this matter careful consideration. Coal known as "run of mine" varies from huge lumps down to slack and dust, commercially known as "culm." Lump coal averages 5 in. in diameter, and the other varieties known as "egg," "chestnut," "buckwheat," "barley," and so forth, indicate by their names their relative sizes. It has been learned by practical experimentation that with a chain grate stoker the work done by the coal increases with the size of coal up to a diameter of about ¼ in. and then decreases until the diameter is about 0.45 in., and then again increases. In fine coals there is a tendency to close up the draft holes, and thus perfect combustion is prevented and a large percentage of ash formed. The enormous quantity of fine dust necessarily produced in the mining of coal is sometimes made use of in the form of "briquettes." A suitable binding material, such as flour or pitch, is used to give coherence to the coal dust when compressed into bricks.

Pure hydrogen, of course, is not a carbon fuel, and the energy set free by the combination of this gas with oxygen, is similar to that obtained by the use of thermit, or in connection with the frightful heat of the electric furnace. Peat, as has been said, is half formed coal, and cannot rival coal as a fuel where coal may be readily obtained. In localities where peat is abundant, and coal is unavailable on account of the expense of transportation, peat is used with success as a fuel. It burns with a bluish flame when first ignited, and continues to do so until the grate bars and spaces are covered with glowing embers. The flame then changes to an intense yellow, and at this stage it sets free its greatest heat. Peat is an excellent producer of gas, and it is used widely for illuminating, heating and furnace purposes.

In Sweden it is used in the production of the famous Siemens-Martin steel, and also as the motive power in the operation of gas engines.

Wood, as a fuel, has about one-half the value of soft coal. A pound of coal is taken as the equivalent of 2.5 lb. of dry wood. A ton of bituminous coal equals about 2.12 cords of wood.

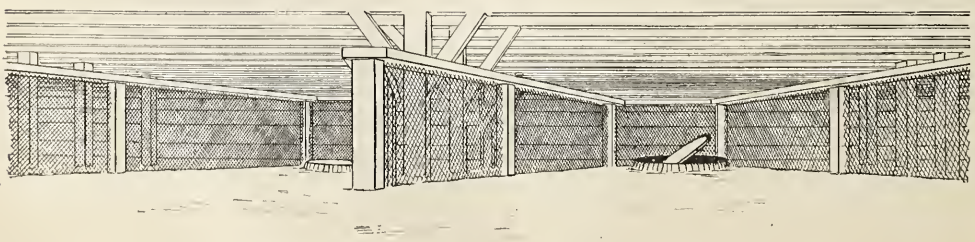
In the Southland, in the midst of the sugar industry, the refuse left after the sugar is extracted from the cane, is used as a fuel and is known as bagasse. Each ton of crushed cane will yield the equivalent of 120 lb. of coal. Owing to its presence as a by-product, bagasse is a cheap fuel and is largely used in the refining of sugar.

In certain favored portions of the United States, natural gas is available as a fuel. This gas was formed in the earth as the result of the chemical decomposition of carbonaceous matter. Its composition is mainly marsh gas, a compound made up of four parts of carbon and one of hydrogen. Fig. 3 shows the relative heating values of the various gases used as fuels. Water gas is produced by passing steam over red-hot coke or coal, and afterwards enriching it with benzine. Blast furnace gas is formed, as its name would indicate, from the chemical decomposition that takes place when pig iron is reduced from iron ore, and is used to a greater extent than formerly. It has high value as a fuel in connection with gas engines, when rid of the dust that is commonly associated with it. Oil gas is produced by the distillation of oil and other liquid hydrocarbons at a very high temperature.

Oil is an ideal fuel, as it has many advantages over all other forms. It has a high heat value and occupies a comparatively small bulk. It is easily stored and easily applied to the furnace. It is transported from well to distribution point by its own gravity. It gives a more equal distribution of heat in a furnace. It does not cake nor form clinkers and cinders. It is free from sulphur, thus adding to the life of boiler plates. It has greater steaming capacity than coal, and on the whole it is greatly to be preferred over all other forms of fuel. It is the crude petroleum that is used, just as it comes out of Mother Nature's laboratory, as the increase in cost of the refined product is greatly in excess of the increase in fuel value. It has been demonstrated that while a pound of anthracite coal will convert 9.7 lb. of water at the boiling point into steam, and a pound of bituminous coal will vaporize 10.14 lb. of water at the boiling point, a pound of fuel oil will transform 16.48 lb. of water at 212° F. into steam at the same temperature, thus illustrating in a practical way, the great fuel value of oil. It is quite probable that in the near future, oil will supplant coal on the larger, ocean-going steamships.

RIDDING SEATTLE OF RATS

Two miles of rat traps will be installed this summer under the docks of Seattle's waterfront by the municipal department of health and sanitation.



The Traps Which Extend Along Two Miles of Waterfront

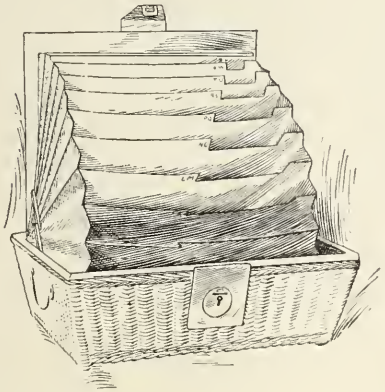
Since the discovery of a case of human plague in Seattle about three years ago the commissioner of health, Dr. J. F. Crichton, has co-operated with the government plague experts to drive rats from the city. So thoroughly has the work been done, that rats have disappeared from the business section. One district, however, that which includes the wooden docks and warehouses, still furnishes rat harborage.

Under the docks, Dr. Crichton plans to place 15 V-shaped corrals of wire netting. At the point of the V is placed a sunken barrel with a trap-door top, which tips as soon as the weight of the rat is on it, dumping the rodent into the pitfall.

The outer tips of these corrals will touch, making two solid miles of traps. The plan is considered more economical than the employment of the large force of city and bounty trappers, which has worked the district for the past two years.

WICKER FILE-BASKET

A file for private correspondence and accounts, which does not look out of place on a woman's desk and is yet highly serviceable, is here illustrated. The lower part is in the form of a basket, made of wicker, and the file

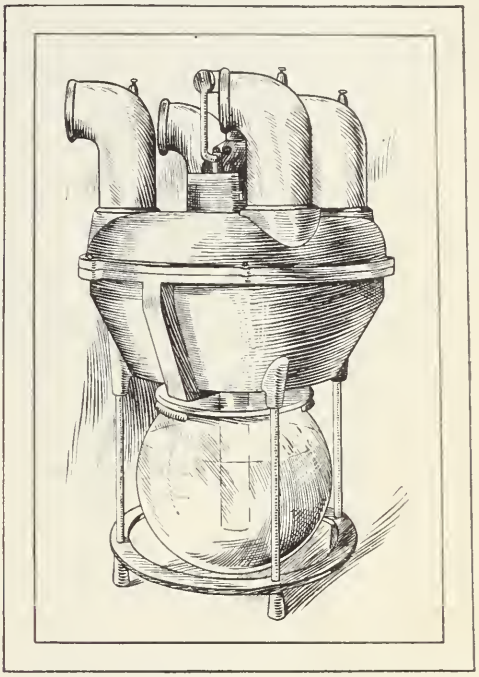


Desk File Especially Designed for Women

proper is of leather, attached to a wicker back, which forms the cover of the basket when pushed down and locked in place.

AIR PURIFYING APPARATUS

This air purifier is a new type of renovating apparatus, consisting of a



Cleans the Air by Bathing it in an Antiseptic Solution

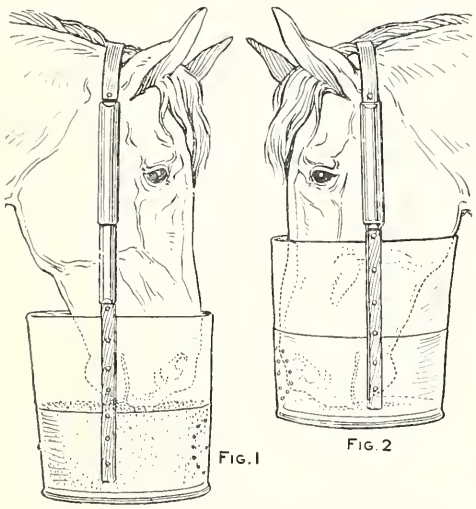
receptacle in which is placed an antiseptic solution. Through this solution the air of the room is drawn by means of a small, motor-driven exhauster, housed within the machine.

The antiseptic solution absorbs carbon monoxide, carbon dioxide, sulphurated hydrogen and other poisonous gases, and also retains all dust particles and bacteria that may be in the air drawn through it. The solution is prepared by dissolving specially prepared powders in water, and is said to give off oxygen in such quantities as to thoroughly revitalize the air of a large room, hall, railroad coach, and other like place in a very short time.

¶For the purpose of making a telephone booth really sound-proof, a German inventor lines it with tin. The method is said to be very successful.

TENSION STRAPS FOR FEED BAGS

The horse feeding from a common feed bag must toss his head to get all



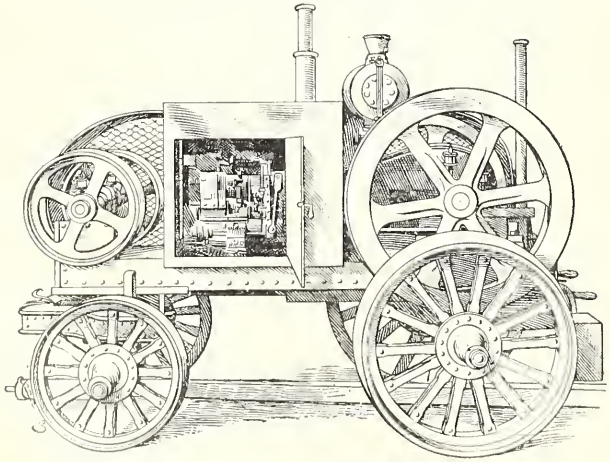
Adjusts the Bag to the Nose of the Horse

the grain. This causes considerable waste, as some of the grain is thrown out. An invention has been brought out and is being manufactured which adjusts the bag to the nose of the horse as the grain is eaten away. It consists of brass tubes, one of which telescopes in the other. An open coil spring is placed in such a way as to draw the tubes together. One of these devices is placed in the strap of the feed bag on each side of the horse's head. In the illustration Fig. 1 shows the horse starting to eat from his portion of feed and Fig. 2 shows how he completes his meal without having to toss his head. The tension of the springs is adjusted so as to keep the level of the grain against the horse's mouth at all times.

CREW OF ITALIAN CRUISER TAUGHT JU-JITSU

Ju-jitsu, the Japanese art of self-defense which became so popular as a fad in this country two or three years ago, is being taught to the crew of the Italian cruiser "Calabria." Just before leaving for Japanese waters the captain of the vessel received orders from the Italian king to let some of his men practice the physical exercises peculiar to Japan. When the ship arrived at Yokohama a teacher of ju-jitsu was procured and the men are now taking lessons.

ALCOHOL ENGINES ON GERMAN FARMS



German Alcohol Engine

A recent article in this magazine drew attention to the fact that the German government allows the farmer to manufacture alcohol for his own use at a low tax. This illustration shows an alcohol engine of the type used on many German farms for agricultural power purposes.

The engine is of the 4-cycle type, mounted on a truck. The valve mechanism and magneto are enclosed in a metal casing for protection against the weather. A countershaft is mounted on the front of the truck and belted to the flywheel of the engine, the power being transmitted to the thresher, pump, or other farm machines, by belting.

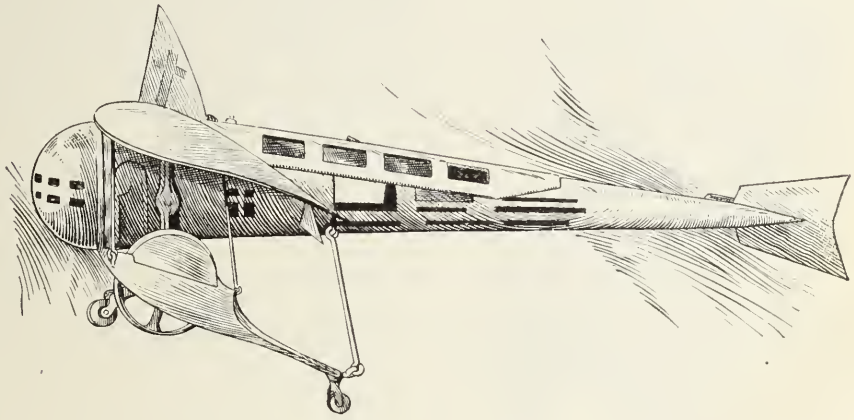
AEROPLANE DESIGNED TO CARRY PASSENGERS INSIDE

In this illustration is seen the model of a new English aeroplane containing many things not in common with the present accepted idea of such machines, one of the most interesting of which is the central torpedo-shaped body for the pilot, passengers, engine and stores. The openings in the head are designed as windows through which the passengers may look. The pilot's seat is just back of the wing-like planes. He is provided with a slightly raised and open section through which he may look out over the machine.

The most important scientific feature of the machine, however, is the means by which the inventor expects to secure automatic stability. The planes or wings are mounted on a ball-bearing collar, which is fixed on the central body, and, if not held in control by the mechanism provided, will oscillate freely on this collar without imparting their motion to the central body. A gust of wind tilting the planes at one side does not heel the central body over, as in the case of machines where wings and body are joined rigidly together.

By an ingenious automatic arrangement, the oscillations of the wings are limited and checked, and this device always tends to keep them horizontal, and so to maintain lateral stability. In other machines this is done by hand-controlled devices.

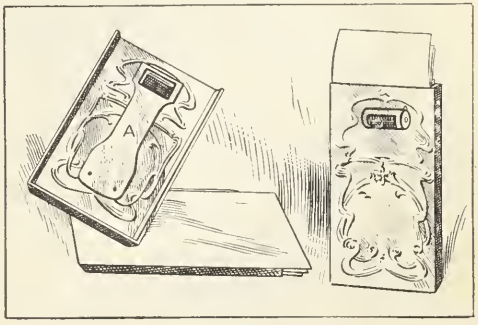
The ideas evolved in this machine are, of course, still only ideas, as the machine has not yet been tried out.



Proposed Type of Aeroplane

IMPROVED CIGARETTE PAPER HOLDER

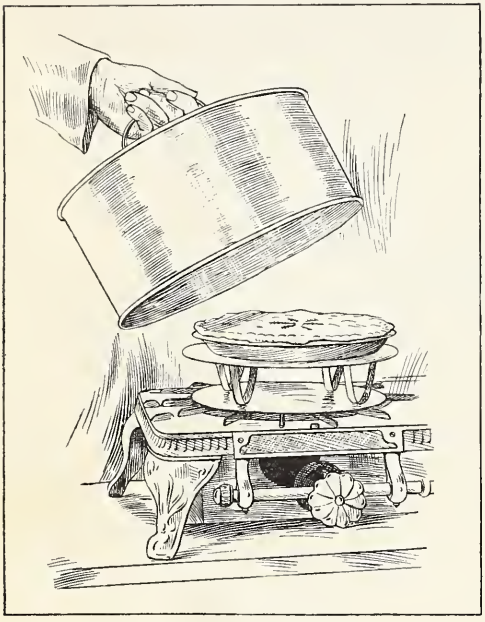
With the ordinary cigarette paper pack, it is often difficult to separate the thin leaves so as to get only one, even though they are blown upon and the finger moistened. To remove this difficulty, a French inventor has devised a holder provided with a piece of rubber in the form of a rowel, which engages with the top leaf in the holder and pushes it out, without disturbing the others.



Holder Provided with Leaf Extractor

SIMPLE OVEN FOR GAS STOVES

An oven that sets over the burner of a gas or gasoline stove and will bake

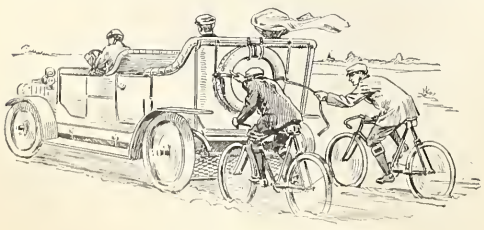


Hooded Oven for Gas Stoves

biscuits, pies, cakes, apples, potatoes, cook vegetables, and roast meats, is here illustrated. It consists of a heating plate of the kind used for heating irons, a stand to support whatever is being cooked, and a drum-shaped hood that sets over the whole.

SUGGESTION TO TRAP TIRE STEALERS

The stealing of spare automobile tires at night by thieves on bicycles, in the manner shown in the first illustration, has resulted in this suggestion, more or less humorous, for trapping the miscreants. The cutting of the straps and removal of the tires automatically throws into action a device which drops the cage trap, with the result shown.

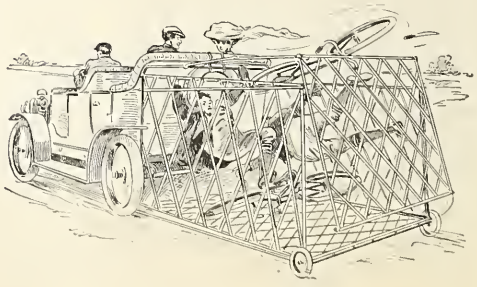


The Tire Stealer at Work

ELECTRO-MAGNETS TO TREAT NERVOUS DISEASES.

A method of electric treatment, just opposite to that now ordinarily in practice, is being utilized by a physician of Zurich, Switzerland, for treating the nervous system. In the usual electric treatment the current itself traverses the body of the patient, while in this method the magnetic fields, or the region outside the circuit, are brought into play. That is, the apparatus works upon the body in the same way that an electric magnet grasps iron, although, of course, the body is not drawn to the magnet, as is the iron.

The electrician who developed the magnet treatment is said to have conceived his idea in 1883, when engaged in directing the electrical installation work at the St. Gothard fortifications. He happened to observe rather strange effects on the organisms of the men working in intense mechanical fields of alternate polarity, as produced by alternate currents. These men seemed generally to enjoy better health than their comrades employed in other places at similar work. Experiments made later, brought out the fact that persons suffering from nervous diseases, especially those affected with facial neuralgia and insomnia, would feel considerable alleviation of their trouble



His Tragic Finish

after staying some time in the neighborhood of electro-magnetic apparatus.

The electro-magnetic field used in the treatment is generated by an alternating current thrown, at 50 cycles per second, through a coil surrounding an iron core. The fact that a violent glow is perceived on placing the magnet near the temples, ascribed to a stimulation of the optical center, demonstrates the possibility of influencing the center of the nervous system through the bones of the skull.

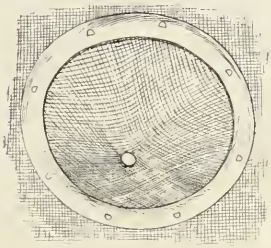
LIGHT AS A BURGLAR EXPELLER

Some time ago one of the engineers of Chicago's largest electric lighting company, devised a system of emergency lighting for residences, by which the turning of a master switch at the head of the bed turns on the lights all over the house. These lights may be ordinarily operated by their respective switches in the usual way, but in case the master switch is turned on, they cannot be turned off by means of the individual switches. This means, of course, that once the master switch has been thrown, any intruder in the house must beat a retreat.

The system is now being used in many Chicago homes.

FLY ESCAPE FOR SCREENS

A device that lets flies out through a screen without letting them in, is here illustrated. It is funnel-shaped, with a hole at the end through which the flies, attracted to the screen by the sunshine, may make their escape. It is attached to the window or door screen by means of a metal ring, after which the part of the screen over which it sets is cut away.



LONG-HANDLED CONCRETE SIDEWALK TROWEL

A long-handled, double-action cement trowel has been designed to take

The New Idea in Concrete Trowels

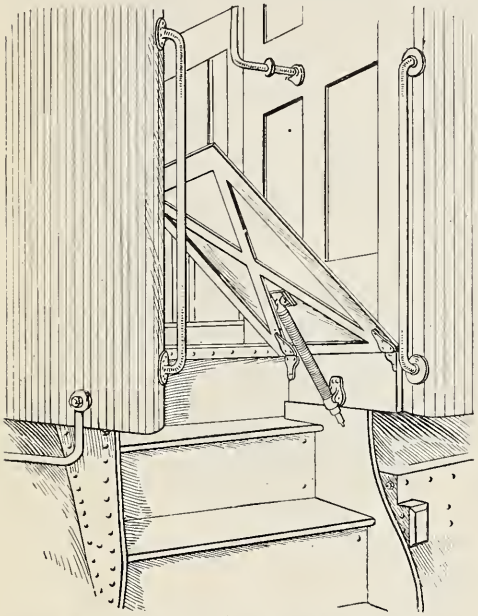
the place in concrete sidewalk construction of the ordinary hand trowel, thus providing an implement by which surfaces can be finished without the necessity of stooping over.

The new trowel smoothes the surface both ways, working with a push and pull movement. As the operator moves it back and forth, the edges are automatically raised to prevent its digging into the mortar.

¶A typewriter was the means by which a deaf witness was interrogated in a New York court recently. The questions were typewritten by a stenographer seated by the side of the lawyers, and read and answered by the witness. A few days later a phonograph was utilized in making records of testimony before the Federal grand jury in that city.

SAFETY TRAP-DOOR FOR TRAIN VESTIBULES

This vestibule trap-door for passenger coaches is of the automatic variety,



Spring Keeps Trap-Door from Swinging into Vertical Position

swinging upward when the lock holding it is released. It has, however, a safety device, in the form of a spring, which is so adjusted that it only rises to an angle of 45° when the lock is released. It thus prevents passengers from falling, if, through any cause, the lock is released. It is necessary for the porter to lift the trap-door from the angle of 45° to a vertical position before the vestibule door may be opened.

PHOTOGRAPHIC REPRODUCTION OF SOUND

The U. S. Consul-General at Stockholm reports a remarkable combination phonograph and kinematograph by which photographs are made to reproduce sound as well as views. The possibility of producing the two at one time is in itself remarkable, but that photographic reproductions can be made to "talk" is the great feature.

The making of the records is explained as follows by Consul-General E. D. Winslow: "No receiver is needed for the speaker; only a small celluloid tube, which may be dispensed with if desired. On one side behind a wall is placed an electric lamp. From this the light passes through two cuvettes (a cuvette is a pot, bucket, or basin in which molten plate glass is carried from the melting-pots) through which water is running. This water absorbs the heat, and then the light passes through a system of lenses in front of a tube. Having passed through these, the ray of light strikes and is reflected in a mirror fastened on a membrane behind the tube, is thrown onto a rotating sensitive plate, and finally draws the sound curve on this negative. This original negative is developed, and the sound curve transferred to plates of ebony. From these the sound is produced as in the gramophone, but without any disturbing secondary sounds.

"So perfect is the reproduction of sounds with the photographone that the inventor can distinguish between and actually read on the curve the different letters of the alphabet, and the photographic plate is so sensitive that the smallest variations in the voice can be studied. The records may be reproduced in great numbers, and the volume of sound may be regulated so as to fill a large concert hall."

PRIVATE IRRIGATION WITHIN SALT RIVER PROJECT

The reclamation system of a private concern will be incorporated within the Salt River irrigation project in Arizona. The Secretary of the Interior has approved a plan for a contract with the company. This canal system irrigates about 24,000 acres and its water right from Salt River was one of the earliest.

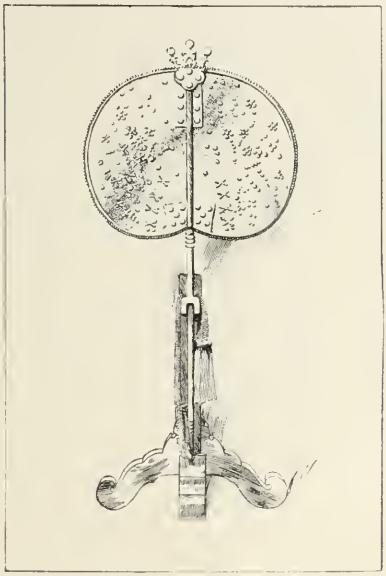
The value of the company's system is estimated to be $6,157,000. The owners of 17,000 acres under the system have expressed their willingness to join the Salt River Valley Water Users' Association and make their lands a part

of the project, and it is understood that the remainder are willing to join, under certain conditions. There are about 100 shares of stock and it is intended to allow the owners to receive credit on account of the value of the stock, as against the amounts due on their applications for water right for their lands. For those who do not join the Water Users' Association, it is proposed to make an appropriate charge for the carriage of the water supply to which they are entitled.

JAPANESE WAR FAN

This curiously shaped fan is an exact reproduction of the "Gumbai Sen" (War Fan), known as one of the priceless treasures in the Japanese Imperial House. The famous fan was taken to Japan from Korea some 300 years ago by one of the most noted of Japanese heroes.

The reproduction here shown was made after several years spent in searching for pearls of exquisite shape and luster. The fan proper is 11 in. by 20 in. in size, embroidered with

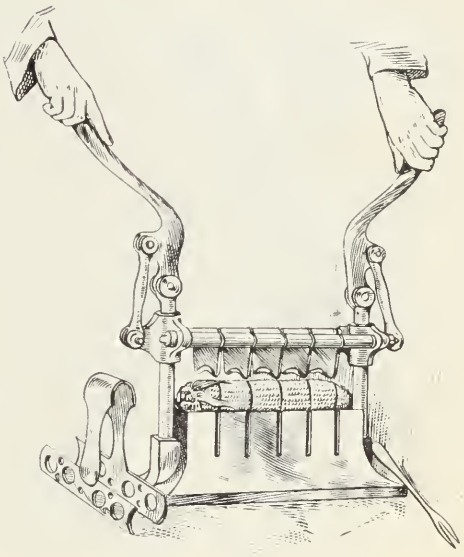


More Than 800 Beautiful Pearls on This Fan

gold threads and beaded with 805 beautiful pearls. The handle is of pure gold.

CUTTER AIDS CORN EATERS

This cutting device, designed for use on the dining table, cuts a cob of green



Cutter for Corn on the Ear

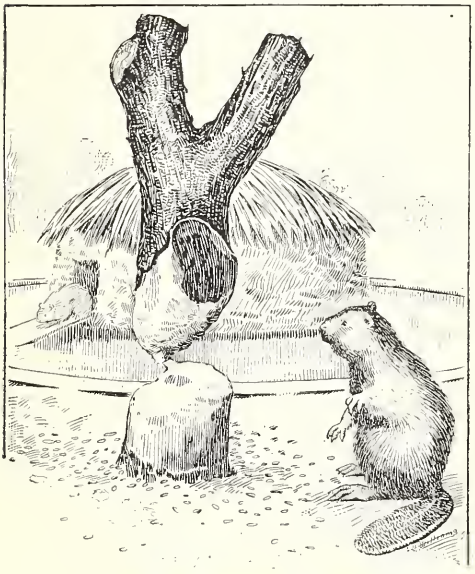
corn into several pieces of convenient size for easy handling. The cob is placed in the trough-like holder and the five knives set above it are pushed downward by means of the handles at each side. The complete service consists of the nickel-plated cutter, and specially constructed tongs and forks for handling the sections of cob.

GOLD FISH AS MOSQUITO EXTERMINATORS

Two varieties of gold fish are to be introduced into the lakes and ponds of Massachusetts, as important factors in a mosquito extermination campaign. There are two varieties of gold fish, the "Heterandria Formosa," and the "Gumbusia Holbrokii," found in North Carolina and Cuba, which easily become acclimated in the northern states and whose entire food is preferably mosquito larvae. The best way to stop the mosquito pest, according to Dr. Samuel Garman, of Harvard, is to send an army of gold fish against them.

BEAVERS GOOD MECHANICS

The gnawing of this tree trunk by beavers in the Zoological Garden at



Tree Trunk Gnawed by Beaver

Regent's Park, London, is a demonstration of their sharp instinctive or, perhaps, reasoning powers. These animal wood-cutters fell trees for the material required to build the dams of their half submerged mounds. In so doing, they select one that is near the water, so that when it is gnawed through sufficiently to allow the wind to blow it down, the likelihood is that it will fall into the water, where it is required.

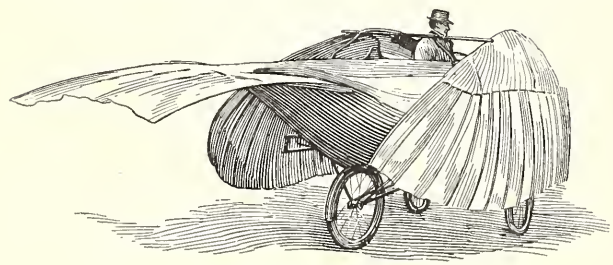
Each year the management of the Zoo plants a new trunk for the beavers to work upon. When the accompanying illustration was made, the trunk had been gnawed through to such an extent that it would sway in the wind, filling the spectators with wonder that it did not topple over. When gnawed just so far, the beavers left it for a more strenuous wind than usual to complete the task, which action on the part of human beings would be considered a wise precaution against possible accident.

FAMOUS SCOTCH BRIDGE RESTORED

"The Auld Brig of Ayr," the bridge in Scotland made immortal by the poet, Robert Burns, has been completely restored, although the work of strengthening it was quite complicated. Concrete was the material used. The bridge has four spans of slightly more than 50-ft. length, and is 12 ft. wide between parapets. The piers formerly rested on 12 by 8-in. oak beams placed on firm boulder clay. Some idea of the age of the bridge is afforded by the fact that one of the spans was considered "new" because rebuilt only 200 years ago.

CURIOUS TRICYCLE-AEROPLANE

This curious aeroplane is intended for operation both on the road and in the air, and comes under the "freak" class of aerial machines, countless numbers of which have been tried and found wanting. A propeller is not to be used for air work, or any ordinary motorcycle-drive for road work. Instead, the inventor expects the beating of the wings, power for which is supplied by a 6-hp. engine, to constitute the means of motion, both on land and in air.



Freak Tricycle-Aeroplane

In its character of a motor-tricycle, the machine requires a license and number plates, which probably makes it the first flying-machine to comply with such regulations.

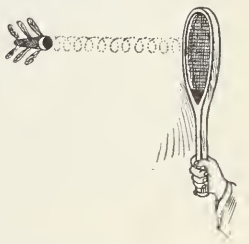
HORSE SPECTACLES RESULT IN HIGH STEPPING

One well-known firm of English opticians, according to a London newspaper, makes a specialty of the manufacture of horse spectacles, the object of which is to develop high-steppers. The glasses used are deeply concave and large in size, set in leather rims that entirely close out sight except through the lens, insuring the attainment of the desired result.

A horse wearing the spectacles gets the idea that the ground just before him is raised, and consequently he steps high. The spectacles are generally used when the horse is young, and the effect upon his step and action is said to be remarkable.

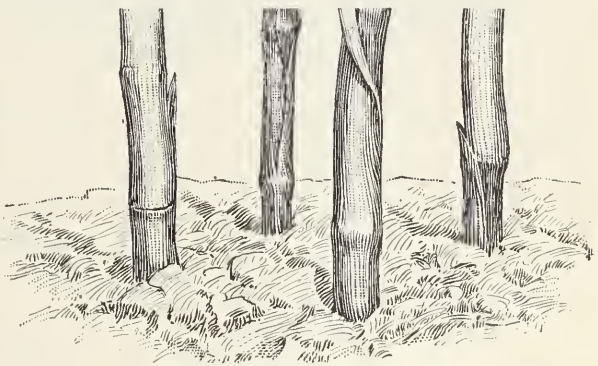
THE FLYING ZEPHYR, A NEW FRENCH GAME

"Le Volant Zephir" (The Flying Zephyr) is the name given this little amusement ball in France. It was inspired by the progress of aviation, and its feathers are arranged in the form of wings. When struck with a racket, it sails through the air with a little of the rising and falling motion of an aeroplane. The game, of course, is to keep the winged ball flying between two players.



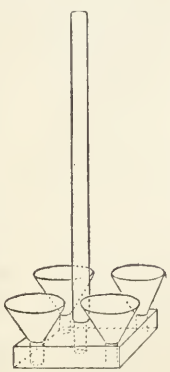
SPACING DEVICE FOR PLANTING CORN

The ordinary method of planting corn in the United States is by machines which deposit the kernels together in a small space. This, according to the Department of Agriculture experts, results in the stunting of many plants because of insufficient space to form strong roots. Just such a state of affairs is shown in the illustration in which one of the stalks is large and the other three stunted.



Perfect Hill of Corn Made Possible by Spacing Machine

Hill of Corn Planted by Ordinary Planter



The Spacing Machine

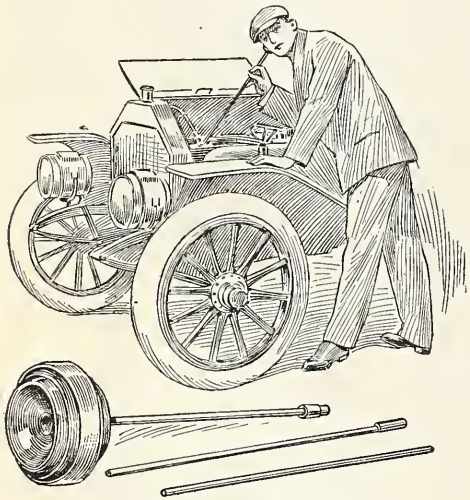
The root system of a corn plant requires a cubic foot of space for foothold, and to provide this, one of the experts of the Bureau of Plant Industry has devised the accompanying spacing tool. By its use, two kernels are planted at each corner of a 5-in. square. In the government tests all the rows were thinned when a foot tall to a uniform stand

of four stalks to the hill, and each hill presented the appearance shown as "a perfect hill" in the illustrations.

The government tests prove that such spacing increases the value of the crop 5 per cent, which means that if this type of spacing machine were to be used universally, the annual crop in the United States would be increased 50,000,000 bushels.

DEVICE FOR LOCATING AUTO TROUBLES

The time to locate engine trouble is before the clicking sound that means something is wrong develops into a



This Device Accentuates the Click

knocking, but this infancy of the knock is usually such as to be difficult to locate. With this device, however, the clicking sound is accentuated until it resembles the noise made by a trip hammer. The transmitting tube is placed against the part of the mechanism where the trouble is believed to be, and the sounding-box is placed against the ear.

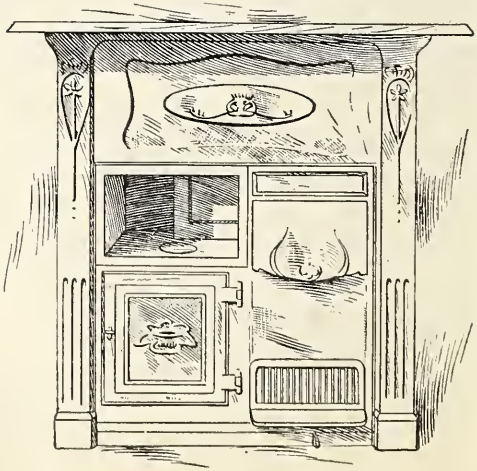
WEIGHTS SADDLE HORSES SHOULD CARRY

During the Paris horse show of this year, an expert jury set themselves the task of determining just how much weight saddle horses of different sizes should carry, so that a fairly definite rule of guidance would be in existence, as an aid in classification.

Conformation of back and size of cannon bore being satisfactory, the jury rendered the decision that, a horse weighing not over 825 lb., with girth 67 in., should not carry more than 187 lb.; a horse weighing not more than 935 lb., with girth of 69 in., not more than 209 lb., and a horse weighing at least 1,045 lb., with a girth of 71 in., not more than 231 lb.

COMBINED FIREPLACE AND COOKER

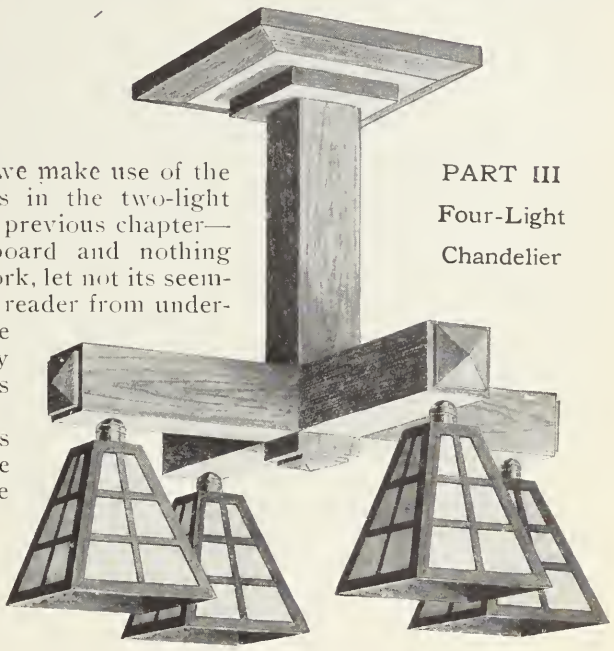
An ingenious combination of fireplace and cooking stove has been evolved in Australia for cottage homes and other dwellings in which the kitchen is used as a living room. Various styles are made, the most simple having a solid firebrick grate and an oven, heated by coal or wood fuel only. A more elaborate design is made for either coal or gas cooking. Nearly all the designs have a recess over the oven, which may be closed with a sliding door and used as a warmer.



Ingenious Australian Stove and Fireplace

THE MAKING OF ARTS-CRAFTS LAMPS

By JOHN D. ADAMS



PART III

Four-Light Chandelier

IN this mission chandelier we make use of the same design of shade as in the two-light portable lamp described in a previous chapter—shades of paper and cardboard and nothing more; and as for the wood work, let not its seeming massiveness frighten the reader from undertaking its construction, for the timbers are not solid—they are all built up of light boards nailed together.

When the woodwork is stained to match that of the room, and the shades are painted a dull black around the framework and lined with an appropriate color of paper, the effect is very attractive, even in daylight, which is often more than can be said of colored glass shades. If a warm green tone of paper is used, when illuminated, the upper portion will appear almost an orange, which will gradually taper off into the true green at the bottom of the shade. After ordinary green tissue paper is used for some time this effect becomes more pronounced, due to some effect that the greater heat of the upper portion has on the paper.

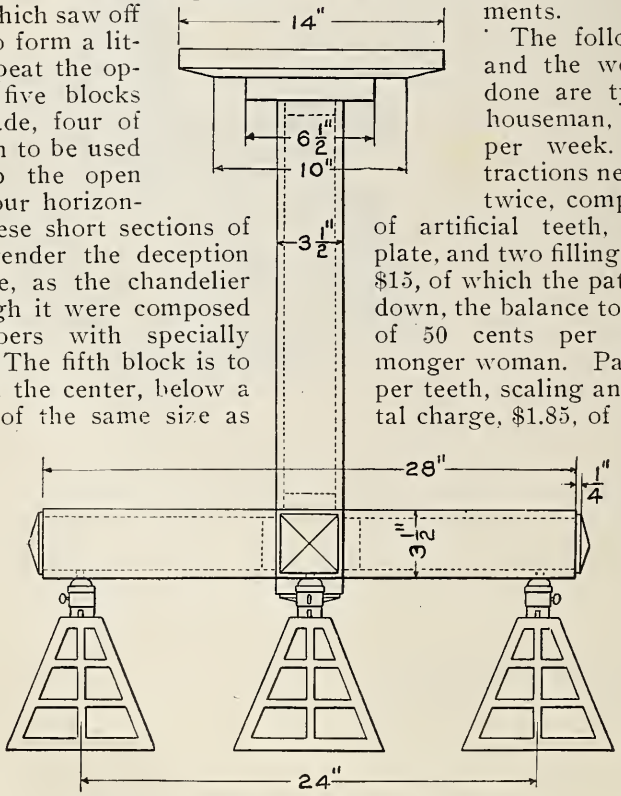
The method of making this form of shade having been already described, nothing more need be said in this regard except to suggest that the same outside dimensions may be retained while the simple cross bars may be replaced with any simple design or pattern required. Occasionally a simple monogram is capable of being concealed in an artistic manner, or else the main motif of the stenciling used on the walls or frieze may be used as a model.

The woodwork should start with the ceiling plate, which is simply a square piece with beveled edges, upon which is fastened a square block. Procure from the mill two or three lengths of ½-in. dressed lumber. From the height of the ceiling, determine the necessary length of the center post, and then simply make a long narrow box, or rather square tube, 3½ in. to the side, of this length. Then make another one, 28 in. long, so as to form two of the horizontal arms in one piece. Two shorter sections must then be made for the two remaining arms. It is absolutely imperative that all the ends of these wooden tubes be perfectly square, which will necessitate a liberal use of the steel try-square.

Next prepare four square blocks, 1 in. thick, of such a size as will exactly fit into the ends of the wooden tubes—that is about 2½ in. Nail and glue one to the center of the ceiling plate. The remaining three are to be attached to the long horizontal section at its middle point and on three of its sides. The object of these blocks will now be apparent. Slip each of the short horizontal sections over a block and make it fast—this forms the horizontal cross.

Now set the center post on the third block and make it fast.

Finally, set the ceiling plate bottom side up on the bench, and then slip the upper end of the center post over the small block and secure it firmly. This completes the assembling of the larger pieces. At all joints use glue and wire nails, the heads of which should be deeply set and puttied over. Procure a short piece of 3 by 3-in. stuff, and work up one end to a dull point as shown, after which saw off a slice so as to form a little block. Repeat the operation until five blocks have been made, four of which are then to be used in closing up the open ends of the four horizontal arms. These short sections of "end" wood render the deception quite complete, as the chandelier looks as though it were composed of solid timbers with specially shaped ends. The fifth block is to be attached at the center, below a second block of the same size as the main timbers.



Details of Four-Light Chandelier Construction

On account of the hollow nature of the structure, the wiring will be found a very simple matter, provided it is attended to before the end blocks are nailed in position permanently.

COST-PRICE DENTISTRY GOOD PHILANTHROPY

A dental surgery was recently founded in London to determine whether $1,000,000 offered by an anonymous philanthropist for establishing cost-price dental parlors should or should not be accepted. Realization of the great amount of ill health caused by neglect of the teeth, and that such neglect is almost universal among the poorer classes because of the excessive cost, were the causes which led to the offer.

That it will benefit the class of people for whom it was conceived was undoubted soon after the experimental parlor was opened. The rush to have work done is so strenuous that patients have to apply in advance for appointments.

The following patients and the work they have done are typical: Warehouseman, wages $4.50 per week. Several extractions necessitating gas twice, complete upper set of artificial teeth, partial lower plate, and two fillings; total charge, $15, of which the patient paid $2.50 down, the balance to be paid at rate of 50 cents per week. Costermonger woman. Partial set of upper teeth, scaling and cleaning; total charge, $1.85, of which 35 cents was paid down, and balance must be paid at rate of 25 cents per week. Girl clerk. Two teeth extracted and stumps drawn, six artificial teeth; total charge, $3.75, of which $1.75 was paid down, balance 25 cents per week. School teacher. Teeth scaled and cleaned; charge, 25 cents.

¶The Department of Agriculture is using ten tons of tree seed in planting trees of the national forests this year. If every seed produced a young tree, the result would be a supply of nursery stock sufficient to plant 300,000 acres.

Beautified Railway Tracks in Australia

BEAUTIFYING THE AUSTRALIAN RAILWAYS

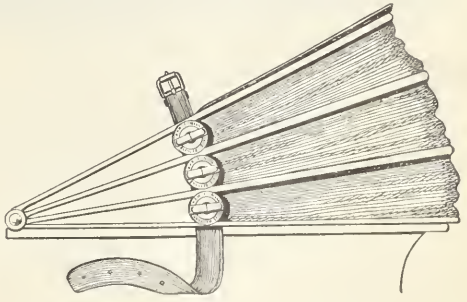
Many miles of the track of the Victorian railways of Australia have been converted from desert-like stretches into beautiful gardens.

A nursery has been established by the railroad and 100,000 plants are about ready for setting out. More than 8,000 gum plants were sent to one roadmaster last year, and 80 per cent of them were successfully planted.

PROTECTORS FOR AUTO HOODS

The life of automobile hoods is greatly prolonged by the adoption of this device, which is called an "insulator" in France. It consists of a strap on which three rubber cylinders or buttons are adjustably mounted. These rubber separators are set between the rounds of the cover and hold them apart, so that they cannot strike against and damage each other, no matter how constant the vibration due to running over rough roads. They also keep the top slightly extended so that the air can readily circulate through and dry it, thus preventing rotting by dampness.

After the rubber separators are



Protective Device in Position

placed in position as shown in the illustration, the end of the strap is passed through the buckle and drawn tight.

¶The annual consumption of ice in the United States is estimated to be 37,000,000 tons, of which 22,000,000 tons is natural ice.

REPLICA OF SPANISH GALLEON BUILT ON PILES

A Ship That Has Never Sailed

One of the unique seaside attractions of the Southern California coast is the ship café "Cabrillo," at Venice of America, the beach resort of Los Angeles. This ship that never ploughs the main was built after the models of the Spanish galleons of old and was named in honor of Cabrillo, the first white man who ever sailed a craft along the California shores. The "Cabrillo" is built on piling and is permanently anchored over the breakers, alongside the pleasure pier. Throughout, it is fitted and furnished after the fashion of an ocean steamship, with bells to note the passing of the ship's watches and on state occasions with uniformed Spanish officers in command. The cost of the ship was $65,000.

"STINGAREE" KILLS SWIMMER

Death in a most unusual form was inflicted upon Laurence Baker, an 11-year-old boy, while diving from a boat near West Palm Beach, Florida. A stingaree, frightened by the plunge, whirled about and struck him with its barbed spines. The stingaree, or sting ray, has one or more large barbed dorsal spines on a whip-like tail.

¶A New York department store is installing a wireless outfit so that passengers on incoming liners may do their shopping by wireless.

AUTOS SPREAD GYPSY-MOTH PLAGUE

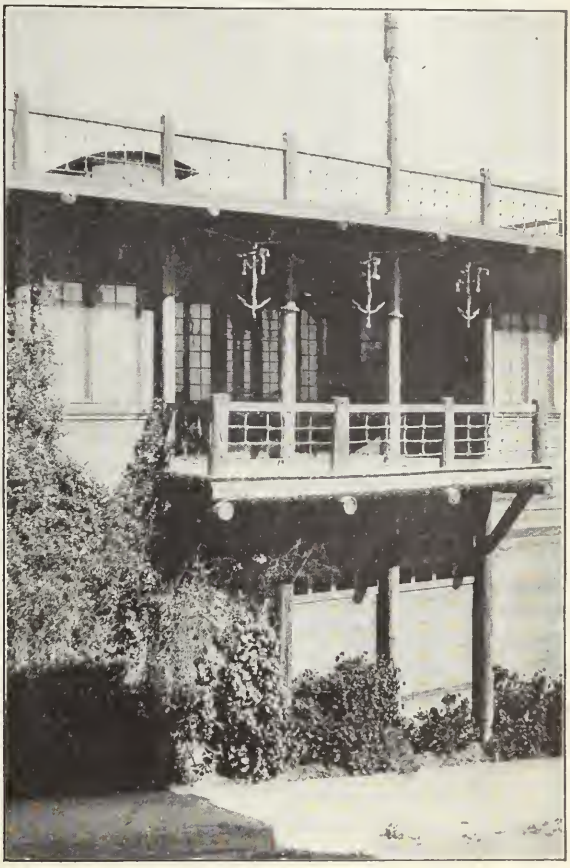
Owing to the fact that the female gypsy moth cannot fly, this insect curse has been more or less successfully confined to the state of Massachusetts, but, curiously enough, the automobile is becoming a serious factor to be dealt with in connection with the problem. The caterpillar of the gypsy moth attaches itself to automobiles whenever the opportunity offers, and then drops off to spin its cocoon at a distance of perhaps several hundred miles from its starting place.

The moth-fighting organization of Massachusetts is striving to clear away all trees and underbrush for a distance of 100 ft. on both sides of the main roads of the state in an endeavor to prevent the pests from availing themselves of this kind of transportation. Other vehicles of all kinds also spread them.

ANCHORS FOR CHANDELIERS IN CLUBHOUSE

A seaside clubhouse at Long Beach, California, has made use of nautical decorations throughout, and the most noteworthy success in novel decorations is the adaptation of anchors for chandeliers. They are suspended on chains about the rustic balconies and are hung with electric bulbs, whose wires are interwoven with the anchor chains, and, when the building was new, each of these bulbs was screened by a very characteristic lamp shade, the large round shell of the sea-urchin. Only a couple of these shells remain,—one may be seen on the anchor in the center —as they are rather brittle.

The clubhouse itself is built in a rustic style and the use of a network of cords in a balustrade carries out the general marine effect.



Appropriate for a Yachting Club

GARDEN FURNITURE MADE OF OLD WARSHIPS

One of the profitable uses to which the English shipwrecking concerns adapt the teak and other woods of old wooden warships, sold to them for breaking up, is garden furniture, such as chairs, settees, etc. One concern is making such chairs of man-o'-war teak. No paint or varnish is used upon them, the natural finish being much more artistic and far superior to such treatment.

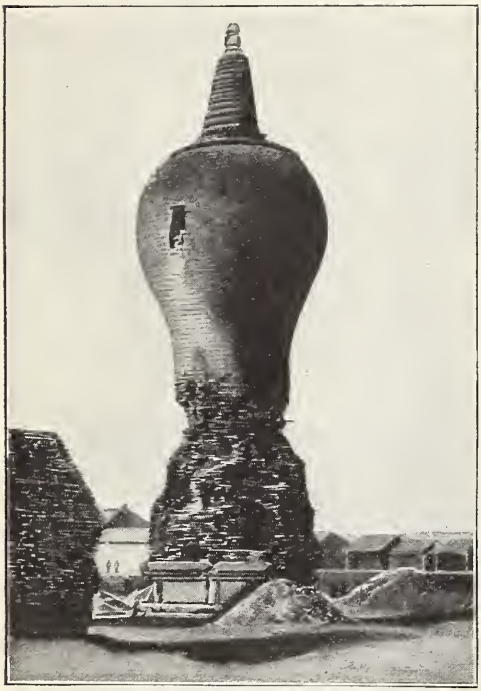
THE NORWAY SEA-FISH HATCHERIES

Figures, taken from the fishery statistics of Norway, show the wonderful results obtained by the cod hatcheries, the operation of which commenced several years ago. The statistics from the Kristainiafjord, inside of Droebak, began in 1872, show an average catch of 75,761 cod in the period between 1872 and 1881, and of 58,476 between 1882 and 1891. In 1892, when cod fry first were planted, the catch was 44,013. Since then there has been a steady increase, and last year the catch was 114,013.

The number of fry, planted in the Kristianiafjord since 1892, is about 170,000,000 valued at about $2,000, while the increase in the catch over and above what it was in 1892, is worth about $225,000. On the west coast of Norway, where hatching has not been conducted, the cod is gradually disappearing from the fjords.

CHINESE DEPOSITORY FOR HUMAN BONES

When the graves in an old Chinese cemetery were opened up in order to



Chinese Sepulchre for Human Bones

make room for a fresh burial, the old bones were deposited in sepulchres of the kind shown in this illustration. The crumbled foundation seen on the left once bore a sepulchre of the same kind, also.

THE WIRELESS PHENOMENON OF DAY AND NIGHT

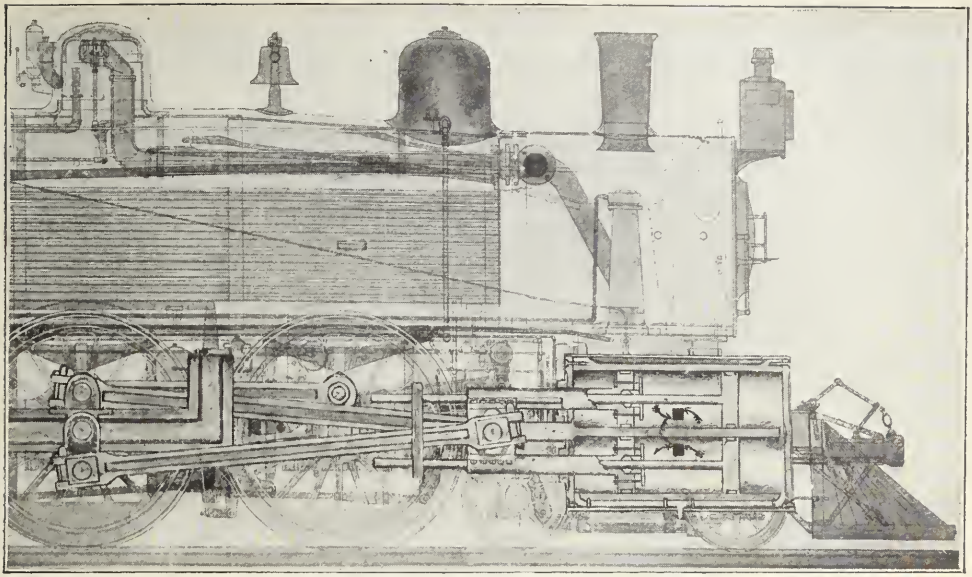
Several reasons have been put forward to account for the fact that a wireless station works better by night than by day, but none of the scientists seem to know the answer. Marconi at first attributed it to some influence exerted by the sun's light on the antennae, but now believes that the upper air, which is always very rich in ions produced by the ultraviolet solar rays, absorbs the energy emitted by the wireless stations during the day.

The effect seems to be rather complex, however, and depends upon the wave-lengths of the Hertzian radiations. By using radiations of great wave-length, about five miles, Marconi has been able to show that the energy during the day may exceed that at night, which is just the opposite of what usually occurs. The long waves lengthen the radius of wireless operation during the middle of the day, yet at other times, notably sunrise and sunset, the waves of small length are preferable.

FLYING SHOES FOR GOOD LUCK

If shoes must be used at a wedding, it might be well to follow the practice in some of the country districts of England. Instead of hurling old boots, shoes and slippers at the couple, friends take one shoe belonging to the bride and one of the groom's, and nail them at the top of a flagpole. This is supposed to bring good luck. At any rate, the shoes can inflict no injury when used in this way.

One Way of Utilizing Old Shoes at a Wedding



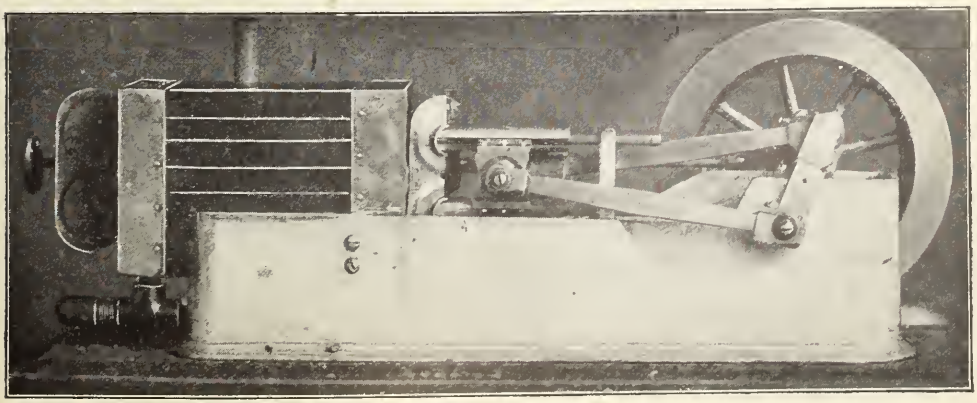
Showing Operation of Engine for Locomotive Use

HEADLESS TWIN-CYLINDER ENGINE

Much interest has been shown in the mechanical world in the headless twin-cylinder engine invented by two New Orleans men. The most radical feature of the engine is that the cylinder heads, instead of being closed and made strong enough to resist great pressure, as is the case with engines of the ordinary type, are open. Features of merit claimed are reduction of fuel with an increase in power and withal an almost entire elimination of vibration.

The engine was tested recently at the plant of the New Orleans Sewerage and Water System.

The steam is introduced between two pistons reciprocating in headless cylinders, utilizing the power lost on the heads of ordinary cylinders. The drawing illustrates the solid piston rod passing through the front or tubular piston rod. It represents twin cylinders, one above the other. The solid piston rod of one is connected with the tubular

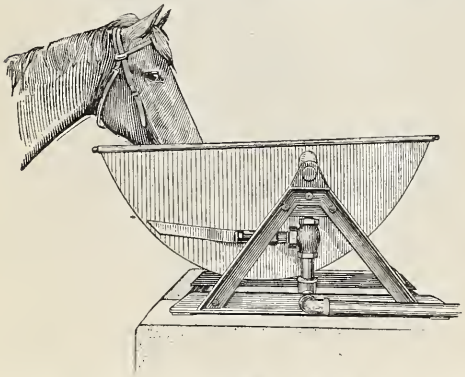


Model of Headless Cylinder Engine

piston rod of the other by means of two crossheads, which are allowed to pass each other, by the tubular rods being slotted. When the pistons in the upper cylinder reach the end of their outward stroke, the pistons of the lower cylinder reach the ends of their inward stroke. The crossheads are connected with the shaft by two main arms. When one main arm is forced forward the other is pulled backward. The steam chest is located on the side between the two cylinders. The steam is admitted to the interior of the cylinders by means of ports, at or near the middle thereof. A slide valve alternately connects the ports with an exhaust and the steam is exhausted from each cylinder alternately. The open ends of the cylinders are closed by suitable doors, shown in the illustration, to exclude dust and other extraneous matter from the interior of the cylinders.

AN AUTOMATIC HORSE AND CATTLE TROUGH

A horse and cattle trough, which automatically provides the horse or the cow with a drink of fresh water any time of the day or night, has been in-



Trough Which Provides Every Horse with Fresh Water

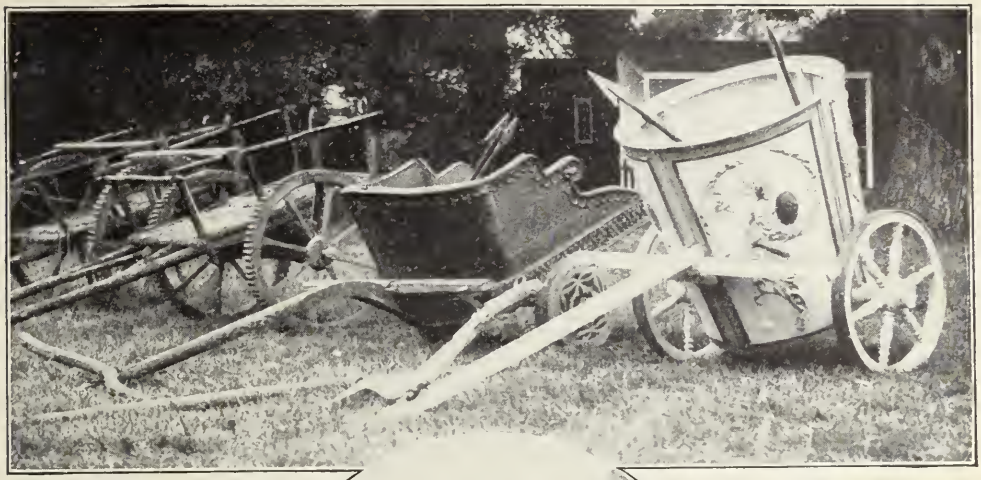
vented by a mechanic of Salt Lake City. The device is so arranged that, when the animal begins to drink from the receptacle, a fresh supply of water is automatically turned in and is shut off when the animal gets through drinking. The trough can be of any size, and can be made to water any number of cattle or horses.

The holder or trough is semi-circular in shape, and is placed on a pivot at a point a couple of inches from the center. When the trough is empty the top is level, the equilibrium being maintained by the weight of the smaller side of the trough and the force of a spring plunger, which regulates the water supply. As the tank is filled with water the equilibrium is shifted to the longer side, and as it becomes filled, the water supply is entirely cut off by the weight of the tank forcing the plunger inward in the supply pipe. As the animal begins to drink the weight is lessened, and the water starts to flow again. The arrangement can be regulated to make the animal drink slowly, or the supply of water for the animal can be limited or entirely cut off.

THE DWARFING OF AMERICAN MARINE

The disappearance of the American merchant flag on the high seas cannot be more graphically recounted than in U. S. Consul Du Bois' terse statement of what had befallen American marine in Far Eastern waters.

"In 1856 there were 1,047 ships, including native craft, entered at Singapore," says the consul, "and of them, 45 were good-sized American merchantman. Four years ago the American ship "Acme" called at Singapore in ballast for repairs; three years ago the "Ivy" called with a cargo of salt and cleared with lumber; two years ago the foreign built American ship "Hanamet" arrived, and last year the barkentine "Jos. L. Eviston" called in ballast and was sold. The total number of vessels entered at Singapore in 1908 was 29,234, of which only one small craft flew the American flag."



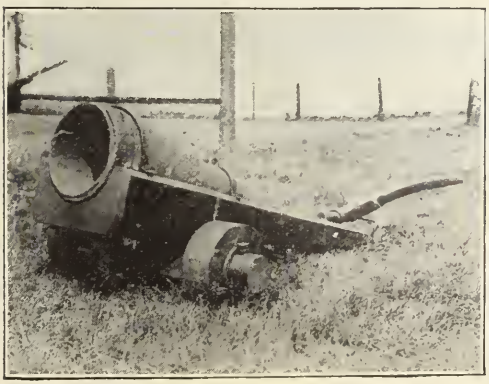
British and Roman War Chariots

RELICS OF OLD WARS

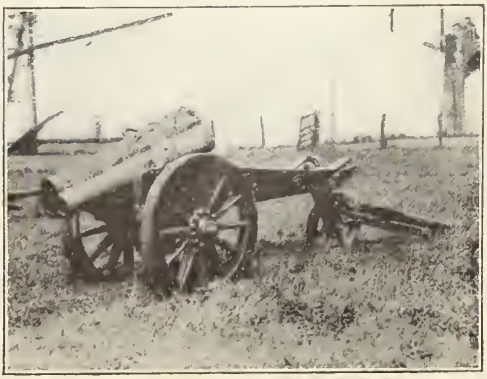
Among the exhibits shown during the British army pageant held in Fulham Palace grounds, which, by the way, is the residence of the Bishop of London, were these curious war implements of the past. The four vehicles in the first illustration are old British and Roman war chariots. The long small-bore gun is a 2-in. cannon used by Charles I. at the battle of Naseby, while the barrel-like device is a bombard used at the battle of Cressy. The three-barreled gun was captured from the French at the battle of Malplaquet.

A comparison of the chariots in the first illustration also demonstrates the broad stretch of civilization between the early Britains and the Romans. The chariots of the former are crude affairs, while the latter are masterpieces of design.

Gun Used by Charles I



An Ancient Bombard



Gun Captured from the French

VEIN MINES NEVER BECOME EXHAUSTED

Placer mining districts become exhausted in time, but the life of vein mines seems unending, although many years of rest may occur between operations.

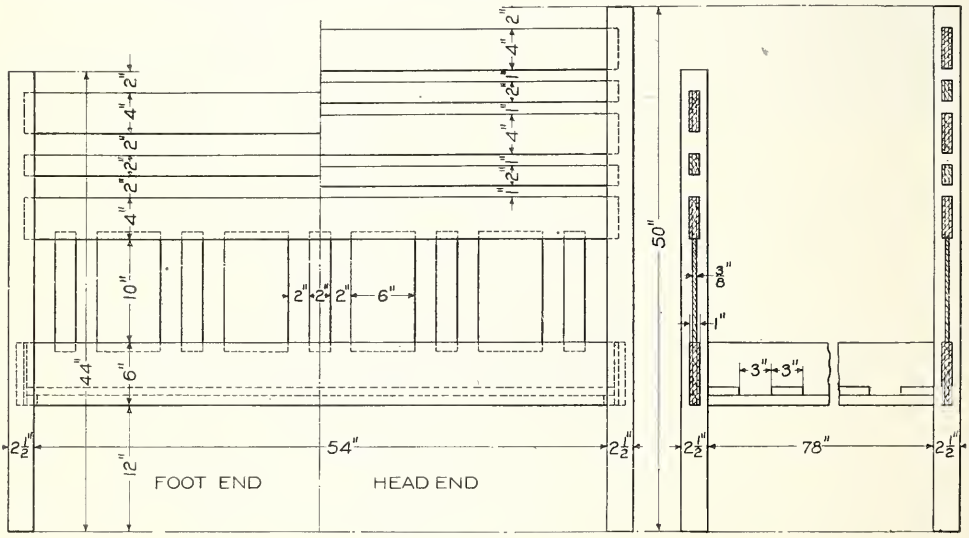
"In the history of the world no district of vein mines has ever been exhausted," says the Mining World in a sweeping statement. "No record exists of a district that has been completely worked out. The mines of Cornwall were worked for their tin nearly 3,000 years ago, and these mines are yet a very important source of the world's supply. The silver mines of Laurium, in Greece, have a known history of 2,500 years, and are still being worked. More than 10,000 slaves were working in these mines in 500 B. C."

Ancient mines in Africa, and especially in Rhodesia, are producing heavily, adding nearly $15,000,000 every year to the world's gold supply.

¶An electric lighting plant has just been installed in the ancient city of Tarsus, Asia Minor. Power is derived from the Cydnus River.

HOW TO MAKE A MISSION BEDSTEAD

The accompanying sketches show an artistic design for a mission bed, so simple in construction and design that most any one that has a few tools and a knowledge of their use can make it. It is best made of quarter-sawed oak, as this wood is the easiest to procure and work up and looks well with any finish. If the stock is ordered from the mill ready cut to length, squared and sanded, much of the hard labor will be saved.



Details of Oak Bedstead

The following is a list of the material needed:

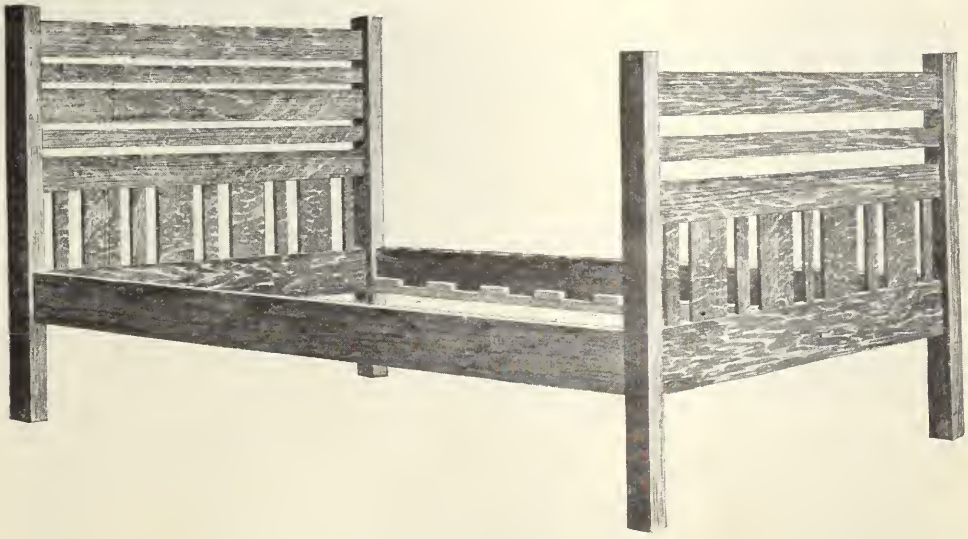
2 posts, 2½ by 2½ by 50 in.
2 posts, 2½ by 2½ by 44 in.
2 end rails, 1 by 6 by 56 in.
2 side rails, 1 by 6 by 78 in.
5 end rails, 1 by 4 by 56 in.
3 end rails, 1 by 2 by 56 in.
8 vertical slats, ⅜ by 6 by 11½ in.
10 vertical slats, ⅜ by 2 by 11½ in.
2 cleats, 1 by 1 by 78 in.
5 slats, ¾ by 3 by 55½ in.
20 blocks, 1 by 1 by 3 in.

Square up the four posts in pairs and lay out the mortises as per drawing. To do this, lay them side by side on a flat surface with the ends square and mark them with a try-square. The tenons on the end rails are laid out in the same manner as the posts. Four of

the end rails should be marked and mortises cut for the upright slats as shown in the detail drawing. The tenons on the end rails are about 1 in. long, while those on the slats can be ¾ in. long. Fit all the parts together before gluing to see that they fit square and tight. After the glue has been applied, clamp them together perfectly square and set them away to dry. They should dry at least twenty-four hours before the clamps are removed.

While the ends are drying, the side rails can be made. These have a 1-in. square cleat screwed to the inner side for the slats to rest upon. If springs are used, five slats will be sufficient. They can be placed where the springs will rest upon them. After the position of the slats has been located, nail small blocks at their sides to hold them in place. For fastening the side rails to the posts, patent devices can be purchased at a local hardware store. The posts will have to be mortised to receive these, and care should be exercised to get them in the right place.

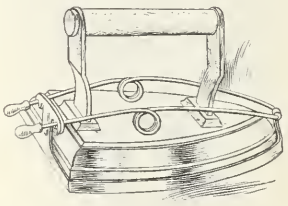
When the bed is complete, go over it carefully and scrape all the surplus glue from about the joints, as the finish will not take where there is any glue. Remove all rough spots with fine sandpaper; then apply the stain you like best, which may be any of the many mission stains supplied by the trade for this purpose. If this bed is well made and finished, it will be an ornament to any home.



Oak Bedstead Complete

OLD FLATIRONS MADE NEW

A shoe of thin nickeled steel, which can be attached to any old flatiron is here illustrated. The old iron, it makes no difference how worn and rough, is first heated over the fire and then the shoe is slipped on, the spring attachment holding it solidly in position.

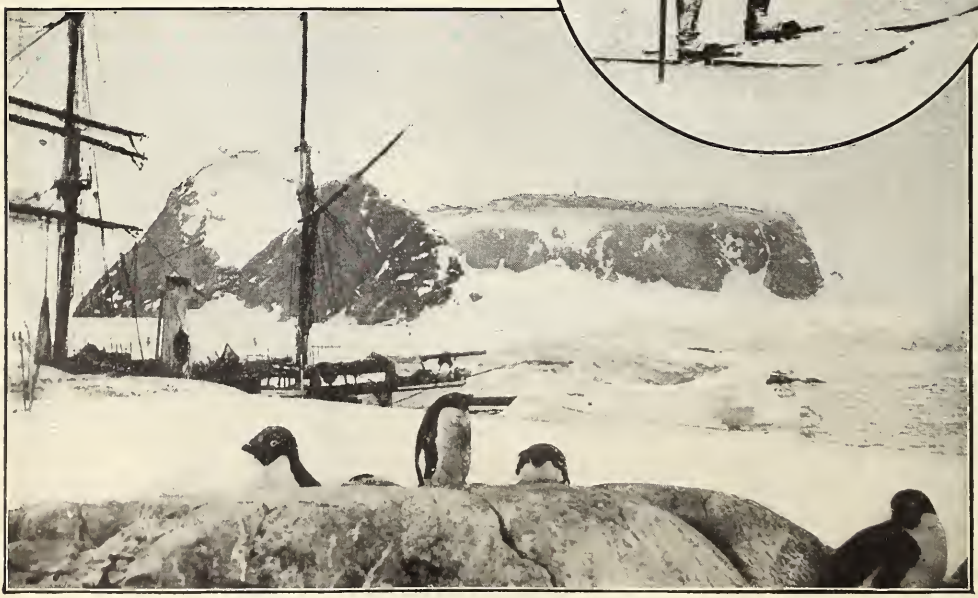


¶The first raft of pulpwood to be towed across Lake Superior from the Canadian to the American side was brought into Ashland, Wis., a few weeks ago. The shipper figured that if 75 per cent reached shore, the venture would pay. Considerably less than 25 per cent was lost.

The French Expedition to the Antarctic

An Arch of Ice

Although it failed to decorate the South Pole with the flag of France, the expedition which pierced the Antarctic under Dr. Charcot made some valuable scientific observations and discovered new land east of King Edward's Land.



Winter Headquarters—Note Penguins in Foreground

Dr. Charcot

Which Made Some Valuable Observations

Constructing Cache for Supplies

These illustrations were made from photographs just received in this country. Although the expedition returned in June, they were withheld for some time. They are remarkably clear for photographs taken in the subdued light of the Antarctic.

Making Magnetic Observations

Landing Supplies from Ship

Making Observations to Find Altitude

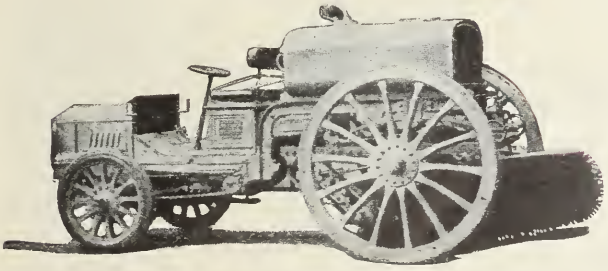
The Meteorological Station

The French Antarctic Expedition Celebrating Mardi Gras Under the Southern Cross

PREVENTIVE OF SCARLET FEVER COMPLICATIONS

Two German physicians announce, after two years' study of the effects of various forms of a specific anti-streptococcic treatment upon scarlet fever, the discovery of a cure for at least the serious after effects of the disease. While admitting that the streptococcus (a long or short chain of cells more or less curved) is not the cause of the disease, and that in the malignant, rapidly fatal cases, it plays no part, they contend that in the severe anginose forms of scarlatina it is constantly present as a secondary infection, and in such cases is more responsible for the fatal outcome than is the scarlatina virus itself.

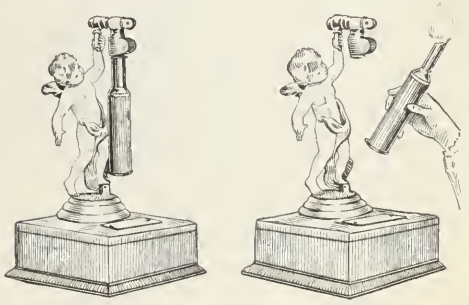
Some 62 cases of scarlet fever, all of which were unusually severe owing to the severity of the infection, were treated by the experimenting physicians, a serum prepared by inoculating horses with cultures being used in connection with vaccine. The majority of the cases treated appeared to be hopeless at the time of the inoculation, but only 24 of the patients died, and of the remainder, the freedom from complications was said to be remarkable. In the entire series there developed not one case of Bright's disease, a common result of scarlet fever. Shortly after inoculation, in nearly all the cases, the appetite of the patients improved, the pulse and respiration strengthened, and the throat became cleaner. A specific serum that will successfully combat the scarlatina virus itself is yet to be discovered.



Motor Revolves Brush

CIGAR-LIGHTERS FOR THE HOME

The cigar-lighter is usually associated with the top of a cigar show-case, but more or less artistic designs of electric cigar-lighters are now being produced and are finding a ready sale as objects of both ornament and service in dens or other rooms where smoking is usual in the home.



Ornamental Cigar-Lighter

The cigar-lighter here illustrated is an excellent example. It is an ornamental Cupid design, heavily gold-plated, with a leatherette-covered torch. The base is made either of mahogany or weathered oak.

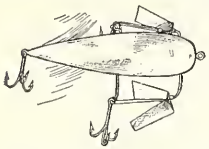
AUTOMOBILE STREET SWEEPER

An automobile street sweeper used in Paris is here illustrated. The sweeper proper is the same type as used on horse-drawn sweepers, but the brush is revolved by chain gear from the motor, instead of by the turning of the rear wheels. The tank mounted on the back part of the body contains water for laying the dust.

¶Old red cedar rail fences of central Tennessee are said to furnish one of the principal sources of wood for pencils.

THE "AEROPLANE" BAIT

This bait is known as the "aeroplane" because of its appearance. The



body is white with polished brass spinners. When used for casting it will float, with the spinner moving on the sides, or the spinners can be so fastened to the bait as to take it down into the water from 6 to 10 ft., according to the length of line used.

HONGKONG'S "WIRELESS" ORDINANCE

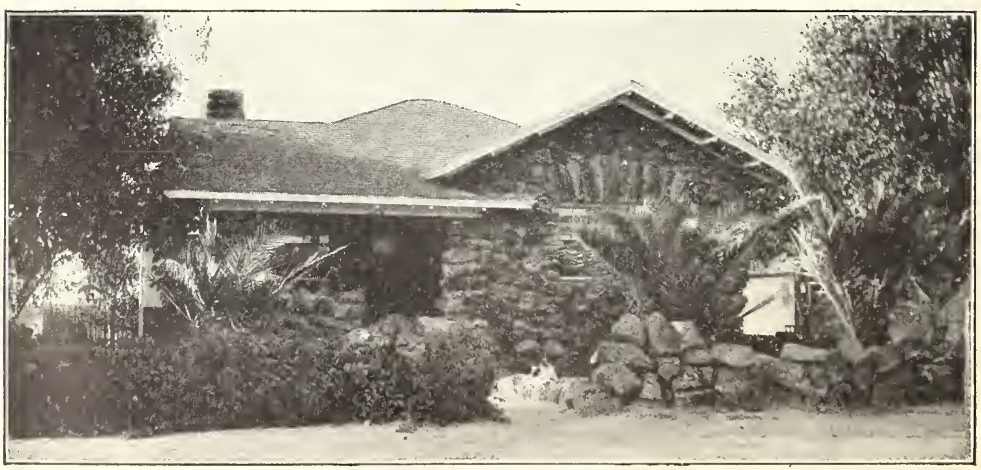
Hongkong, being an English crown colony, has a wireless telegraph ordinance very much the same as that in vogue in England. All apparatus on a merchant ship in the territorial waters of the colony must be worked in such a way as not to interfere with naval signaling, or with the working of any wireless telegraph station, especially when the latter is sending messages to ships at sea. Also, no apparatus on board a merchant ship shall be worked or used while such ship is in any of the harbors, except with the special or general permission, in writing, of the postmaster-general of the colony. If at any time, in the opinion of this official, an emergency arises in which it is expedient for the public service that the government have control over the transmission of messages, ships in territorial waters shall be subject to such further rules as shall be made.

These regulations apply to all conditions except the making or answering of signals of distress.

A HOUSE BUILT OF LAVA

One of the most attractive little homes in Tucson, Arizona, is built of the rough lava blocks which are plentiful on the mountain slopes thereabout. As the blocks are not shaped nor smoothed, they lend a certain rustic appearance to the building, which is very inviting. The lava is porous and of a dark color, as if it had been burned or scorched. It will be noticed that the fence is of the same construction, giving a harmonious appearance to the place.

A curious bit of gossip concerning the house is that the builder became dissatisfied with it for some reason and decided to raffle it, and, as gambling was allowed in Arizona until the last few years, there was enough of the spirit of chance in the community to cause a ready market for his tickets. It is said that in this way the place was disposed of at a large profit.



Made of Volcano's Product

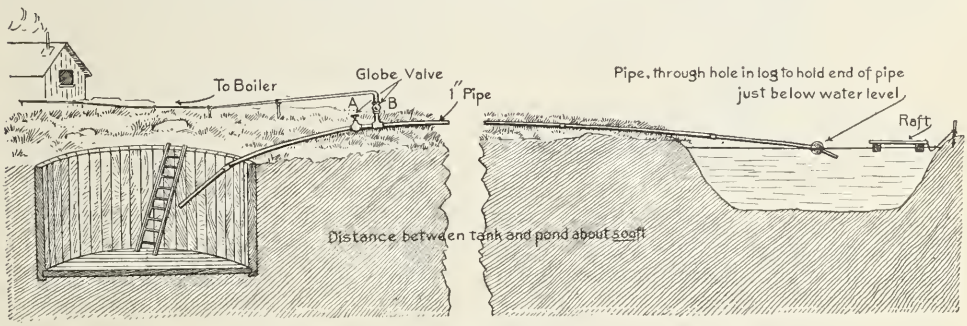
SHOP NOTES

Siphoning Water from a Pond

A steam boiler, using water from a tank supplied by rain from the roof, had to be shut down during the dry season. On one occasion when the water supply failed and the plant was shut down, I decided to fill the tank from an old cellar that had been discarded on account of striking a spring that would fill it in about a day and a half.

I put a line of 1-in. pipe to the cellar, extending the end to the middle of the pond. A hole was bored in a log of wood and the end of the pipe was inserted through the hole far enough to keep it just below the surface of the water. A raft was made from two railroad ties and used to get at the end of the pipe for filling it with water. A piece of pipe having sufficient length to reach almost to the bottom of the tank was attached to the pipeline at an angle. The end in the tank was plugged and the end in the pond raised and the whole pipeline filled by using a funnel, then the end was lowered into the water and the plug removed from the pipe in the tank. This started the siphon and the tank was filled.

At times when the water in the tank would be low and there was not enough water in the boiler to safely start a fire in the morning, I would close the globe valve A, and open the valve B. The vacuum formed in the boiler caused by the steam going down would be sufficient to draw water up from the pond and into the boiler to a level where it would show in the bottom of the gauge. The siphon would be started and the tank filled. This arrangement was kept in successful operation for a long time, or until natural gas was supplied to the city. Then a gas engine was installed to take the place of the steam engine.—Contributed by C. G. Smith, Brooklyn, N. Y.



Filling Tank with a Siphon

To Keep Varnish from Crawling

Painters often have trouble in keeping the second coat of varnish from crawling away from the first, especially in cold weather. A simple remedy for this is to go over the first coat with benzine and allow it to dry before applying the second coat of varnish. The benzine leaves a gray film upon the varnish, which does not injure it in the least and causes the second coat to stick. To do a first-class job of varnishing, the temperature in the room should be about 65 deg. F.—Contributed by F. L. King, Islip, L. I.

Joining the Limbs of a Tree

When a tree is small, but with sufficient growth, select two small branches

Limbs Joined Together by Nature's Growth

growing opposite and as near the crotch as possible, as shown at A in the sketch, and twine them together horizontally, one overlapping the other as a rope is twisted, leaving the ends free as in B. It will take about a year for nature to join them. Then prune the ends off smooth and in time as the bark expands through the growth of the tree the connection will become as one solid piece, C, thereby binding the limbs together. This method may be used several times in one tree. Trees treated in this manner will not split through rapid growth or by the wind. This method can be applied to all fruit trees except the peach tree.—Contributed by D. English, Norwood, O.

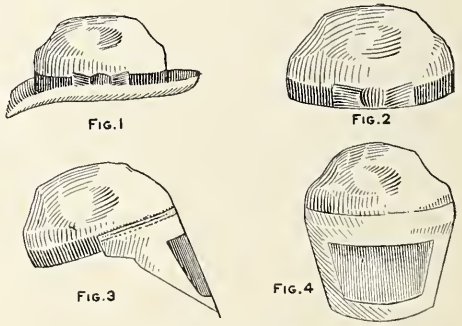
Coloring Iron and Steel for Laying Out Work

Various substances, such as blue vitriol, red lead, soapstone, chalk and Prussian blue, are used to coat metals which are to be laid out. There is a good method of doing this work, however, which requires none of these coloring substances, in fact, requires nothing but a fire. The lines show up clearly, and are finer than can be made with any of the above named substances.

It will not jar off, and the metal can be filed right up to the line, which makes it especially useful to tool-makers. To prepare the metal, simply put it in the fire, preferably inside of a piece of pipe, and heat it anywhere from a blue to a dull red. Then cool it quickly in water. This leaves the surface blackened, and lines scratched on it show up bright and clear, and the contrast between the black and the bright, clean-cut line is agreeably marked.—Contributed by D. Hampson, Middletown, N. Y.

Protector for the Eyes While Grinding

Glass protectors for the eyes are not always satisfactory, as they are liable to become covered with moisture from the perspiration of the face and make it hard for the user to see. Persons doing a great deal of grinding on emery wheels should protect their eyes with some kind of a shield. The one shown in the illustration is easily made and can be used with more comfort than ordinary glasses. Take a felt hat, Fig. 1, and remove the rim as shown in Fig. 2. Make and attach a cardboard shield as shown in Fig. 3. The cardboard has

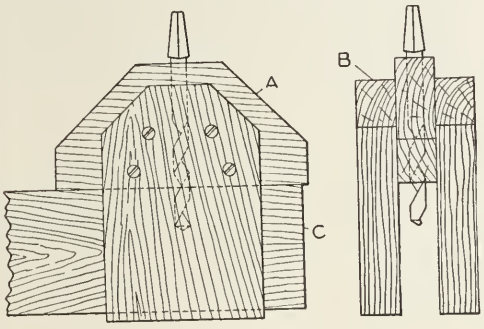


Cap and Eye Protector

an opening cut out and a piece of celluloid stitched in for the transparent window.—Contributed by C. C. Brabant, Alpena, Mich.

Gauging Dowel-Pin Holes

When boring dowel pin holes in parts that are to be fitted together it is often a very difficult matter to get them in straight so that the parts will fit squarely when assembled. When a number of holes are to be bored, the little gauge shown in the accompanying sketch will prove quite handy. It is a time saver and also insures accurate work. It consists of a block A, to which the two side pieces B, are fastened with screws. The block A has a hole in it to guide the bit. The side pieces serve to hold it squarely on the work. Make a punch mark on the work C to be bored, and slide the gauge over it until the point of the bit strikes the mark. Then bore the hole for the dowel. The gauge is to be held steadily

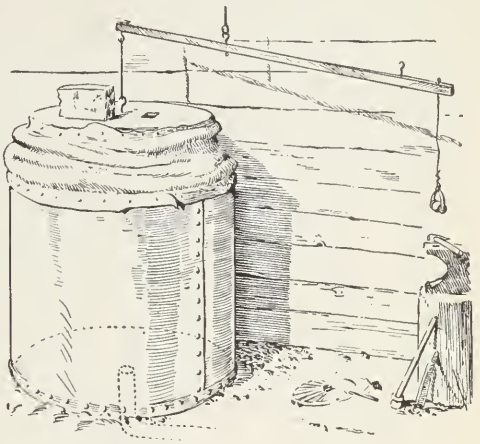


Boring Dowel Holes Straight

on the work with one hand while the other turns the brace and bit.—Contributed by Edward Moore, Philadelphia, Pa.

Blacksmiths' Bellows Made from an Old Tank

A serviceable blacksmiths' bellows can be made from an old tank by arranging it as shown in the accompanying sketch. Secure an airtight tank and remove the top. Fasten a wide band of soft and pliable leather around the top with a hoop and some rivets making an airtight joint. Make a round wooden top somewhat smaller than the opening in the tank and fit an air valve on the under side of it. Tack the upper edge of the leather to this top, care being taken to get it as nearly airtight as possible. Attach a handle as shown



Old Tank Used for Bellows

and place a weight on the top to make the leather fold into the tank, and to give pressure to the air. A few strokes of the handle will compress enough air to hold the leather up, then the weight in bringing it down forces the air to the tuyeres through the pipe at the bottom of the tank. This bellows does not need to be pumped steadily if the leather band is made wide enough, as sufficient air will be stored in the tank under pressure to supply the needs of the forge for some little time.

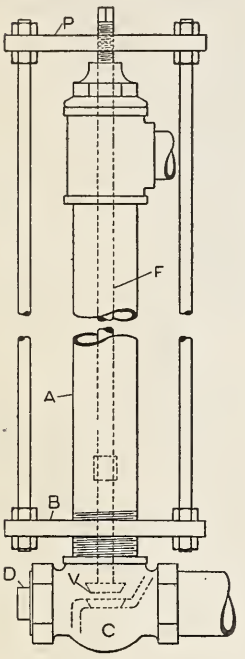
The tank can be put up out of the way, either in a corner or above the furnace hood, the lever hooked to the ceiling, and a wire handle run down to within reach.—Contributed by F. M. Berchmaus, Scio, Ore.

Makeshift Hook Lock

A simple lock for a hook is made by driving a nail about 2 in. above the staple and bending the end over so it can be turned either way. To lock the hook, turn the nail over it as shown in the sketch.—Contributed by Thos. L. Parker, Olaf, Iowa.

Home-Made Steam Trap

A steam trap is a self-acting device by means of which water that accumulates in a pipe or vessel containing steam will be discharged without permitting steam to escape. The means of doing this are various. Most of the traps make use of the expansion of metals to open a valve and the one shown in the accompanying sketch is no exception.



The pipe A can be of any size and should be at least 3 ft. long and have enough threads cut on the lower end to permit it to be screwed through the plate B, then into the globe valve C which has the bonnet removed. This valve should have the one end plugged as shown at D. A tee is screwed to the upper end of the pipe A, and on this is screwed the bonnet of the valve C. A rod, F, is connected to the valve stem and has the upper end threaded to screw through the plate P for adjustment. The end of the rod is square so that a wrench can be applied. The two plates B and P are held apart by means of the side rods R which have lock-nuts at both ends.

In operation the water accumulates in the pipe until the rod cools and contracts, thus opening the valve V, allowing the water to escape. As soon as the water is replaced by steam, the rod expands and closes the valve. This trap is very easily made and if properly adjusted, will work as well as any of the expensive ones upon the market.—Contributed by J. E. Noble, Toronto, Canada.

Breaking Large Bottles with Boiling Oil

The method of breaking small bottles or vessels at the place wanted with a kerosene-soaked string is well known, but this method does not work so well with the larger vessels. Following is a method by which any sized glass vessel can be broken,—as for example, a glass tub to be made out of a carboy:

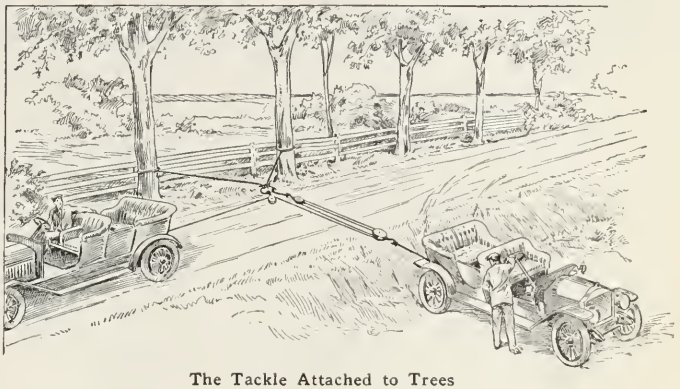
Fill the vessel with cold water up to the point at which it is to be broken. Pour enough boiling oil over the water to make a good coat on the surface, and before the oil has time to cool, dash cold water on the outside of the vessel. A clean break at the contact point of oil and water will be the result.—Contributed by F. M. J. Berchmaus, Scio, Oregon.

Substitute Bowl for a Lamp

A fruit jar is a very handy article to use as a temporary lamp bowl when that part of the lamp is accidentally broken and you cannot replace it at once. Take the fruit jar cap and cut a hole in the top with an old knife, the size of the screw end on the lamp burner. Make the hole so the burner will fit tightly in the cap, and then use wax or soap to seal the burner in place to keep out the air. The only precaution is to have the burner fit the hole tight enough to keep it in place. This temporary bowl, used with care, will give good service until a new lamp or a new bowl can be procured.—Contributed by C. C. Brabant, Alpena, Mich.

Removing an Automobile from a Ditch

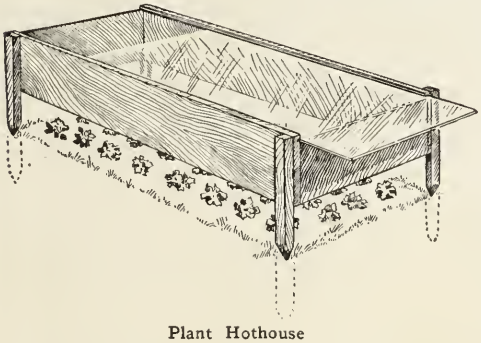
It is a true saying that "necessity is the mother of invention" and so it is that only a few know how to properly apply tools and material at hand in the case of an emergency. The accompanying sketch shows how I rigged a tackle to a very unusual condition in a case where an automobile was ditched and a straight pull could not be made, as the roadway was too narrow. A block and tackle was used with the double block near the load to increase the efficiency. The sketch clearly illustrates how the tackle was applied.—C. G. S.



The Tackle Attached to Trees

Small Movable Hothouse for Plants

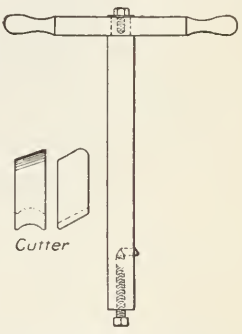
The small hothouse shown in the illustration can be used to protect plants from severe cold weather and high winds. The house can be moved from place to place to cover delicate plants or start seeds early in the season. It consists of a box without top or bottom and grooves cut for inserting a glass cover. The stakes at the corners will sink into the soil, holding the house firmly in place. The glass can be removed during the day and closed at night.—Contributed by W. A. Jaquythe, Richmond, Cal.



Plant Hothouse

Hand Boring Bar for a Large Pulley

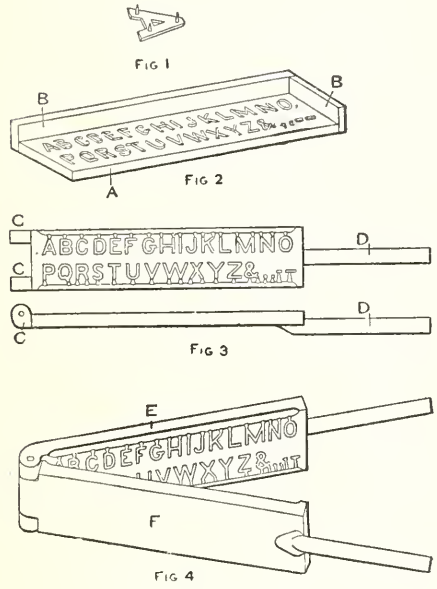
Large diameter pulleys and gears are often brought to the small repair shop to be rebored. If the shop does not have a lathe or boring mill large enough for the purpose, some other method must be employed. The job can be done very easily by hand if a tool like the one shown in the accompanying sketch is made.



To make the tool procure a piece of shaft that will just fit the hole already in the gear or pulley. Square one end and attach a handle as shown. Drill a hole in the bottom end of the shaft and tap it for a set screw. Cut a square hole at the upper end of this for the cutting tool. A sufficient amount of shaft should extend the cutter to act as a guide. Forge the back end of the cutting tool to fit the taper on the end of the set screw. In making a cut, turn the set screw up until the tool cuts as deep as is wanted. If more than one cut is made, a sleeve must be slipped over the lower end of the bar to act as a guide, as after the first cut the shaft would not fit the hole.—Contributed by J. N. Bagley, Webber, Kans.

Home-Made Pattern Letters and Figures

In carrying out the modern systems of the classifying, marking and recording sets of foundry patterns, it is frequently necessary to use large quantities of pattern letters and figures. A



Mold for Letters

condition of this nature occurred recently, in which many thousands of letters and figures were needed to properly inaugurate a new system of this kind, says a correspondent of the American Machinist. After a somewhat lengthy consideration of the matter, the following method was worked up and used with entire satisfaction, not only as to its efficiency and economy, but as to the quality of the product and the ease with which the letters and figures were applied to the patterns. The method of doing this work was as follows.

The letters and figures wanted were each to have two or more sharp points projecting from the back, by which they might be quickly and permanently attached to the pattern. This form is shown in Fig. 1. The plan was to make good and durable molds and to cast the letters of an alloy similar to type metal. To make molds of metal, as brass, and work out the forms by hand would have been much too expensive. Therefore some cheaper method must be devised.

In making the molds, several sets of good pattern letters and figures of the "sharp gothic" style were purchased. A ½-in. board, A, as shown in Fig. 2, was prepared shellacked and rubbed down, after which a rather heavy coat of shellac was applied and the letters arranged upon it as shown, while all around it were placed the strips BB in box-like form. The letters were very slightly oiled, and plaster of paris was mixed rather thin, poured into this box and as it was beginning to set was rammed down hard. When the plaster had thoroughly set, the strips BB were carefully removed and the plaster cast separated from the board A and the letters. It was then smoothed up on the back. The chamfers to facilitate, pouring and the "gates," one or more to each letter, were carefully cut, and it was given two light coats of shellac. The hinge lugs CC and the handle D were made of wood, but not attached to the plaster. This served as a pattern which was carefully molded in fine sand and a casting made of brass. The casting appeared as shown at E, Fig. 4.

In the meantime a wood pattern was made for the other half, F, of a jointed mold shown in Fig. 4, and also cast of brass. This casting was planed up on the face and casting E fitted to it by a slight straightening with a hammer and a file finish. The two were then clamped together and the rivet hole in the hinge lugs drilled and the rivet inserted. It will be noticed that the alphabet is arranged in two lines so as not to make the mold too long and narrow, and the "gates" so made as to pour the metal from either side so as to avoid long gates,

which would have the effect of cooling the metal and result in defective letters.

A smaller mold for figures was made in the same manner, except that in arranging the figures there was one of each figure, with the exception that there were three of figure 1, two of figure 6 (reversed to form the 9), and four of the figure 0.

The sharp points on the back of the letters and figures were provided for in this manner. The mold was closed and some melted lead, heated very hot, was poured into the mold. This marked the outline of the letters on the plain side of the mold. The location of the points was then marked with a prick punch. A small twist drill was ground to the proper form and the holes drilled to the depth required.

The molds having been made, the more difficult conditions of casting had to be considered and solved. This required considerable patient experiment in order to obtain a proper alloy, and to ascertain the proper temperature of the mold. This temperature was finally found to be much higher than at first supposed practicable. First the proper alloy. Various proportions of lead, antimony and bismuth were tried. A fair success was reached, with one of lead, 90 parts; bismuth, 10 parts. But this was later on improved by one composed of lead, 70 parts; bismuth, 12 parts; antimony, 18 parts.

Possibly the addition of a small quantity of tin might have improved the alloy, but in practice it is well to avoid too many ingredients lest mistakes in the exact proportions occur.

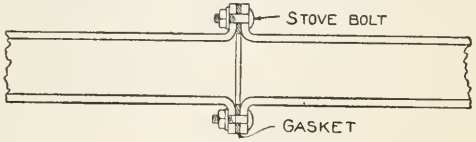
In the process of casting, the mold was closed and clamped by slipping a ring over the handles in the same manner that the blacksmith does over his tongs. It was necessary to heat the molds over a gas flame, hot enough to slightly discolor a pine stick held against them. The alloy was melted over a Bunsen burner, care being used not to overheat it, as even slightly overheating tended to destroy its fluidity. The test used was that it be hot enough to burn a pine stick to a rich brown.

An apprentice boy in casting these letters and figures used two molds, one in the process of heating, while he was casting with the other. By the use of these molds and the proper alloy, a boy was soon taught to be able to produce between two and three thousand good letters and figures per day. There was no finishing work required except to clip off the "gates" with a ¼-in pattern-maker's chisel, held at the same angle as the inclination of the side of the letter.

Lead Pipe Connection without a Wipe Joint

The accompanying sketch shows how a quick repair was made on a heavy lead pipe. In moving my sink from the basement to the first floor I had to lengthen the lead pipe, and not having the necessary tools or knowledge for making a wipe joint, I used the following method to join the ends of the pipe:

A child's top was used to turn out the lead on the ends of the pipe. This being done, I cut a rubber gasket from the sole of an old rubber shoe, placed it between the flanged ends of the pipe, and then drove a nail through the lead and rubber to make holes for the bolts. Four common stove bolts were used in



Gasket in the Joint

drawing the flanged ends tightly together on the gasket.—Contributed by C. C. Brabant, Alpena, Mich.

¶A heavy lathe cut will not do accurate work.

Housing a Clothesline in a Post

The care of the ordinary rope clothesline is not a little task when it must be put up and taken down each time there are clothes to dry. The line cannot be kept clean, nor will it last long if left stretched between posts all the time. A simple method for housing a line, and one that makes it handy to place the rope between posts quickly is shown in the sketch. The housing consists of a hollow post used for one of the line posts. The bottom part of this post is a solid piece of square timber, set in the ground and the top part boxed in with 1-in. boards. In Fig. 1 is shown the post complete. The rope passes over a series of pulleys, similar to a block and tackle, to which a weight is attached. The arrangement of the pulleys is shown in Fig. 2. It is obvious that when the rope is detached from the outer post it will be drawn by the weight into the hollow post, where it is housed until the next washday.—Contributed by Herbert Hahn, Chicago, Illinois.

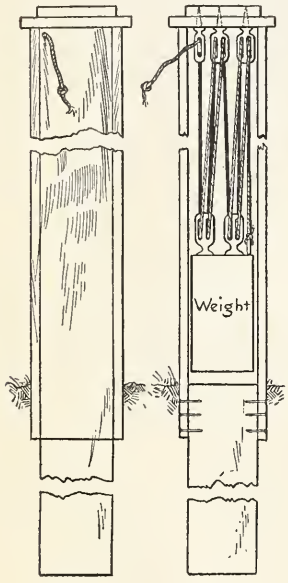


FIG. 1 FIG. 2

Preparing Plaster Walls for Papering

When preparing a ceiling for papering do not pull down any loose plaster, but get some tin washers used for fastening tar paper on roofs. Fasten the plaster on with these in the same manner as putting on the tar paper, driving the nails into the joists. Cover the washers over with plaster-of-paris. The washers will support the plaster and the paper can be put on in the usual manner.—Contributed by Norval Bradley, Paterson, N. J.

Wedge Vise for a Woodworker's Bench

The vise consists of three blocks of 2-in. pine, two of which are nailed solidly to the bench. Two of the blocks, one which is nailed and the wedge, are slightly beveled. This is to prevent the wedge and also the board from rising. The vise is tightened by placing the board to be held between the blocks and driving the wedge in tightly. The wedge is driven back to loosen the grip. In Figs. 1, 2 and 3, is shown respectively the side, end and plan view, and in Fig. 4 the perspective of the finished vise. The grip of this vise will not mark or otherwise injure the wood being held by it.—Contributed by Aaron Austin, Ontario, Can.

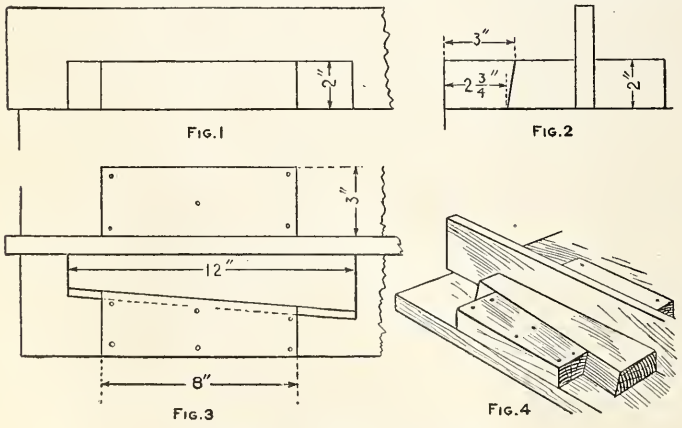


FIG. 1 FIG. 2 FIG. 3 FIG. 4

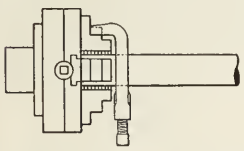
Vise Made of Blocks and a Wedge

Preventing Sore Hands Caused by Metol Developer

In using metol as a photographic developer, it sometimes happens that the hands of the operator become affected in certain places with a sort of eczema, causing the skin to peel off in scales and finally producing sores and wounds. By accident I happened to find an excellent remedy for this skin trouble in the juice which is pressed from the pores of a fresh orange peel, says a correspondent of the Moving Picture World. In case of eczema of this kind, several applications of this juice rubbed into the affected skin will cure the trouble in 24 to 48 hours, producing a perfectly smooth skin. In severe cases the healing process will take a little longer.

Holding Heavy Work in a Chuck

The accompanying sketch shows a handy method of assisting a chuck to drive heavy work. With a universal chuck it is especially useful as it is sometimes difficult to drive a heavy cut without having the chuck so tight that it is under a strain. As this is poor policy the lathe dog may be used to help out as shown. It is driven by its tail, which is set against one of the chuck jaws, thus working in conjunction with the chuck as driver.—Contributed by D. A. Hampson, Middletown, N. Y.



Adjustable Swing Table

A table or shelf which can be swung into the position most convenient, or out of the way when not in use, and that can be adjusted to any height, is a handy addition to a workbench. It can also be used as a seat. Fasten an iron pipe, P, firmly at the top and bottom by sinking it into wooden blocks, BB, which are nailed to the wall or a post. Cut a piece of board to the size and shape desired for the shelf. To this fit an iron strap, S, 2 or 3 in. wide, bent as shown in the detail

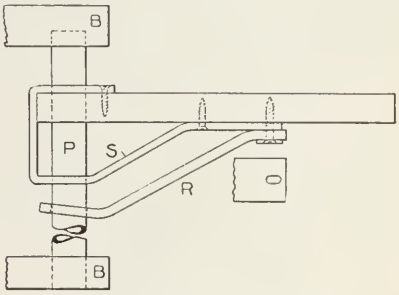
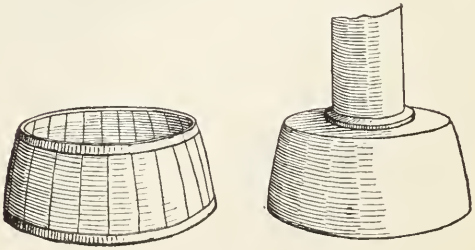


Table Can Be Raised and Lowered

sketch, and drill holes for the iron. These holes should be an easy sliding fit. In another and rather heavier iron strap, R, drill a hole at one end slightly larger than the diameter of the pipe. At the other end make a slotted hole as shown. Bend the strap and attach it to the wooden shelf and the pipe, then by the familiar principle of "binding" this shelf can be adjusted to any desired height and it will hold its position.—Contributed by C. W. Nieman, New York, N. Y.

Round Concrete Column Base Forms

A very cheap and quickly made form for making bases for columns is a barrel or keg sawed in two in the middle.

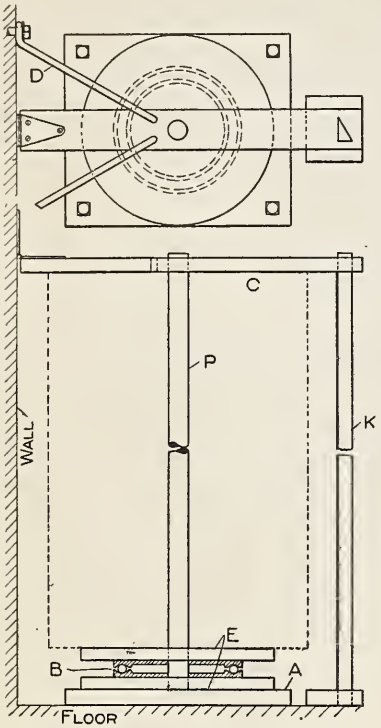


Barrel Used as the Form

The form and the completed base are shown in the accompanying sketch.—Contributed by W. A. Jaquythe, Richmond, Cal.

A Paper-Holder and Cutter

A design of a paper-holder and cutter for large, heavy rolls of paper is shown in the accompanying sketch.



Plan and Elevation of Paper-Holder

This holder may be any size in order to accommodate any diameter or length of roll. The base A is bolted to the floor; then a ball-bearing fastened to it as shown. The balls roll between two iron disks which are bolted to two circular wood pieces, E. The center post, P, may be of wood or gas pipe and should be somewhat longer than the roll of paper to be used. The post is held at the top by a crosspiece, C, which is in turn braced by the side rods D, and is hinged to the wall as shown. The knife K is held in place by means of a block on the floor and the end of the brace C.—Contributed by D. Netter, Meridian, Miss.

¶Do not lubricate magneto bearings too freely.

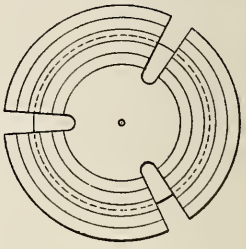
Making Corncribs Rat-Proof

Secure some heavy screen wire and cover the walls and overhead with it, using care about the corners, joints and openings to make them close. Let the wire extend down to the bottom of the crib, then make a concrete floor or bottom, allowing the concrete to come up 2 or 3 in. on the screen wire. This floor can be made on the ground, using plenty of rock for drainage, or it can be made by covering an elevated floor with the concrete.

In this way nearly the entire loss caused by rats and mice can be prevented. The wire will permit the air to pass through the bin as freely as would the usual slat or board construction. In this way the corn saved in one year would pay the expense of the concrete floor and screen lining for the crib, and the lining and floor would last many years.

Centering Tool for Wood-Workers

A sheet-metal disk with notches cut in it, and fine, circular lines drawn on its surface as shown in the accompanying sketch, makes a handy tool for quickly finding the centers of round stock, and is especially adapted for use by pattern-makers and wood-turners. Simply place it on the end of the stock, move it about until the edge of the piece coincides with the concentric lines, as seen through the slots, and then mark the center. It can be made any size desired.—Contributed by P. H. Campbell.



¶Clean coal tar pitch, free from water, acids, or soluble mineral matter, is the most efficient type of covering for iron pipes to prevent corrosion from contact with soil, or electrolysis.

Renewing an Old Window Wiper

In using an ordinary rubber window wiper the corners will invariably wear off, which causes streaks at the edges of the window when used. In this shape it is practically useless and the result is that a new one must be purchased, unless remedied.

By loosening and removing the handle, the rubber center can be pushed through the zinc holder, thus allowing the holder to have the worn ends trimmed off. Trim the rubber center to suit the holder, replace the handle, and the wiper is just as good as a new one, except that it is a trifle narrower. —Contributed by Felix Herz, Goldfield, Colorado.

Home-Made Rubber Curry Comb

One of the best things for removing the loose hairs from a horse when he is shedding is a rubber having an uneven surface. A comb of this kind can be made of a block of wood, 5/8 in. thick, 3 or 4 in. wide and 6 in. long. Tack a piece of corrugated rubber, a piece of rubber stair pad will do, on one surface of the block. Make a handle and fasten it to the other side of the block. The rubber tacked to the block is shown in Fig. 1 and the side view showing the handle in Fig. 2.—Contributed by Earl Streit, Newark, Ohio.

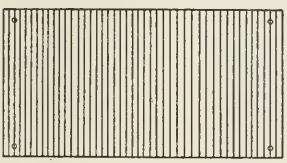


FIG. 1

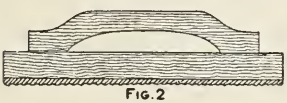


FIG. 2

Door Mat Made of Old Ropes

An outside door mat that will make a good substitute for the expensive metal or rubber mat can be made of old manila rope or clothesline, as shown in Fig. 1. The frame is made up of 3/8-in. lumber, cut to the desired length for the sides and ends. The ends of the pieces are mitered and nailed together. The wooden crosspieces for the center of the mat, each of which

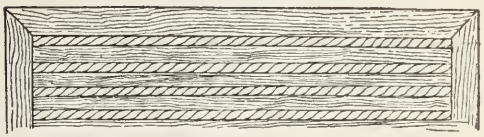


FIG. 1

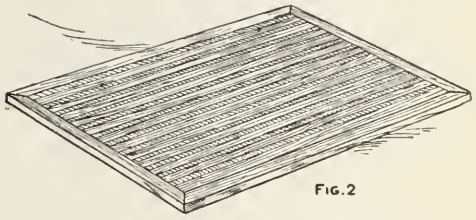


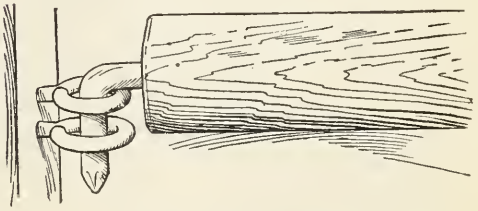
FIG. 2

Frame Made of Ropes and Wood

should be about 1 in. wide, are cut to fit the inside of the frame. Cut the rope or clothesline in pieces the same length as the wooden crosspieces. Lay the frame on a level surface and start by placing one piece of rope along one side. Then place one wooden crosspiece against the rope and nail through it and the rope into the frame. Continue this process until the frame is filled with alternate pieces of rope and wooden crosspieces. The completed mat is shown in Fig. 2.—Contributed by C. C. Brabant, Alpena, Mich.

Sanitary Chicken Roost

The roost is made round without any groove to harbor insects. It can be quickly removed, cleaned and replaced. Two screw eyes are turned into the wall in a vertical position, from 1/2 to 3/4

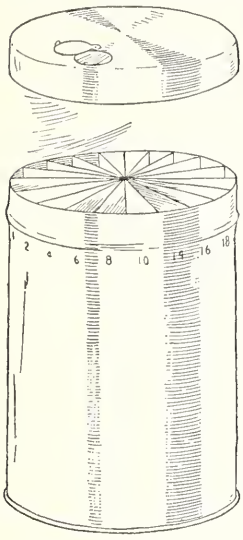


Hook in End of Pole

in. apart. Each end of the roost is provided with a hook or nail as shown.—Contributed by W. A. Jaquythe, Richmond, Cal.

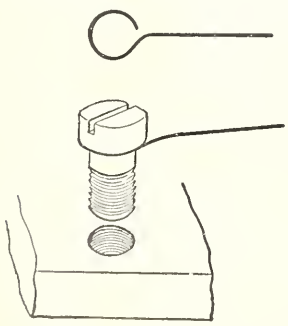
A Twist Drill Box

Small twist drills are apt to become lost or mislaid when not in use, if they are not kept in some special box or place provided for that purpose. A handy and easily made box for holding them is shown in the accompanying sketch. Secure an empty baking powder box and solder as many partitions in it as you have different sizes of drills. Make a hole in the lid, close to the edge, large enough to accommodate the largest drill. Now when the lid is in place on the box this hole can be turned to any desired compartment and a drill removed from it. A slide can be made to fit over the hole as shown. Each compartment of the box should have the size of the drill it contains stamped on the outside.—Contributed by C. G. Smith, Brooklyn, New York.



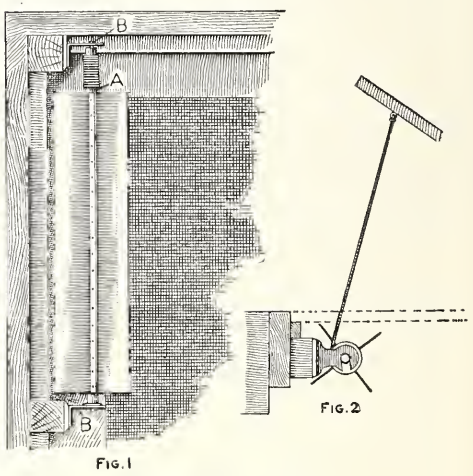
Inserting Small Screws

The illustration shows a method of holding very small screws ready for insertion in their holes, when one finds it clumsy and difficult to hold them with the fingers and manipulate the screwdriver, says Machinery. Take a piece of small wire and bend the end into a loop equal in diameter to the body of the screw. When the latter is dropped into the ring thus formed, it will be supported steadily, so that it can be readily inserted in the hole. After two or three turns with the screwdriver, remove the wire by pulling it. This will straighten it and free the screw.



Driving Flies Away from a Screen Door

The largest number of flies flock to the upper portion of a screen door ready to enter as soon as the door is opened. It takes some time to drive the flies away before opening the door. The illustration shows a device designed to do the "shooing" automatically when the door is opened. In Fig. 1 is shown the corner of the door with the device in place, and in Fig. 2, the top end.



Automatic Fly "Shooer"

An old curtain pole, A, is sawed off within 1 in. of the long, coiled spring inside and then placed in an upright position between the regular pole hangers BB. Blocks are used to make a support for the hangers. A cord having a length equal to the distance from the corner of the door when opened, to the pole, is fastened to these two parts, and the spring is wound up to about the same tension as for a curtain.

Four strips cut from the curtain material are doubled and tacked to the pole just below the cord to form fans. It is apparent that when the door is opened the cord will revolve the pole, and if the fans just touch the door frame, they will make such a noise that no flies will venture near.—Contributed by Frank L. Walter, Dayton, O.

Cutting Glass Disks

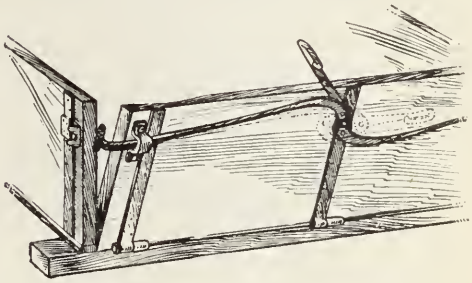
A simple method of cutting glass disks is shown in the accompanying sketch. Fasten a short piece of gas pipe in the lathe and bevel one end to a rather sharp edge and to the size you want the disks. The bevel can be inside or outside or both, to get the desired size. Heat the beveled end red hot, then stand the pipe on end and place the glass centrally on the hot beveled end as shown. The hot metal will cause the glass to break out in almost perfect disks.—Contributed by P. H. Campbell.

Tool for Putting on Automobile Tires

An old pair of bicycle forks, spread to 8 in. or more, makes a handy tool for replacing automobile shoes and tubes. In operation, put the forks under one side of the shoe and force the tire over to the inside rim, then pry up and you will have free access for placing the valve or lugs. A number of tools can be purchased for this work, but the old bicycle forks will beat them all at much smaller cost.—C. G. S.

Handy End Gate Clamp

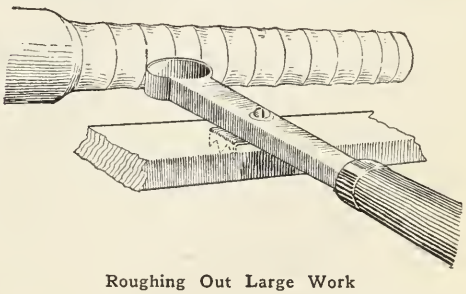
An end gate clamp that can be opened with one hand is shown in the accompanying sketch. Deliverymen, especially, will find this device handy for they can hold packages, crates, sacks, etc., in one hand and open the end gate with the other. This device is very simple and inexpensive and can be made by any blacksmith in a couple of hours.—Contributed by L. W. Van Nasdale, Lemoyne, Pa.



End Board Fastener

Turning Tool for Large Wood Pieces

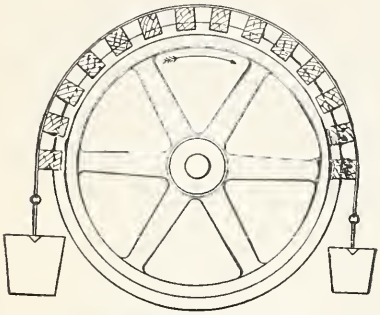
The ordinary tool used in roughing out large pieces of wood has a tendency to catch in the work and cause trouble. In using a circular-edged tool all of the material of the cut will be removed and no jagged ends left to draw the tool into the work. If such a tool is made as shown in the illustration, with a hole or opening for clearance, a deep cut can be made without drawing the tool into the turning wood. The handle is provided with a U-shaped piece of metal having saw-teeth edges on the place where it comes in contact with the rest.



Roughing Out Large Work

Finding the Brake Horsepower

A very accurate way to determine the brake horsepower of a gasoline engine is to use an arrangement as shown in the illustration. The device



Showing Direction of Pull

consists of a number of blocks fastened to an old piece of belt, to the ends of which weights are attached. The blocks are made of pine, and for a small engine, 2 by 4-in. timbers will do. Cut a recess in each block to fit over the rim of the flywheel to prevent them from slipping off when the engine is running. The recesses should be cut about ½-in. wider than the rim of the wheel to prevent them binding on the sides.

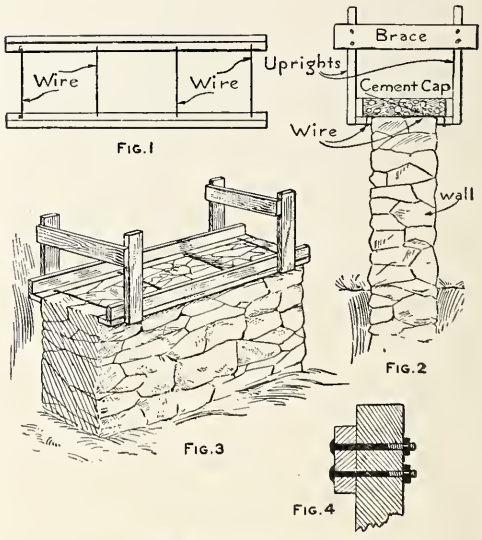
The blocks are fastened with screws to a piece of belt that is long enough to reach over the wheel and hang below the center on each side. Attach a bucket to each end of the belt, one of them larger than the other, the large one being pulled in the direction of the arrow. Place a quantity of sand in both buckets and start the engine. Keep adding sand to the large bucket until the engine is working to almost its limit without affecting the speed. Let the engine run in this manner for a few minutes, until you are sure the test is right, then stop it and weigh the contents of the buckets. The difference in pounds is the number of pounds pulled. Multiply the circumference of the wheel by the number of pounds pulled, the result by the number of revolutions per minute, and then divide the product by 33,000. This will give the actual brake horsepower of the engine.—Contributed by J. N. Bagley, Webber, Kansas.

Protecting a Newly Painted Wall from Flies and Dirt

After the paint on the wall has thoroughly dried, make some laundry starch, thin it out until it will flow nicely under a brush, and apply a coat to the wall. It will dry clearly and protect the paint. When the wall gets dirty all that is necessary to clean it is to wash off the starch and apply another coat.—Contributed by F. L. King, Islip, L. I.

Forms for Cement Coping on Walls

An old, crumbling stone wall can be repaired and given a neat appearance by laying on a cement coping. A contractor repaired such a wall by removing the crumbled portion and placing the cement on top in forms constructed as shown in the sketch. The forms consisted of pine boards, fastened together at intervals with heavy wire, as shown in Fig. 1, to prevent its drop-



The Form Construction

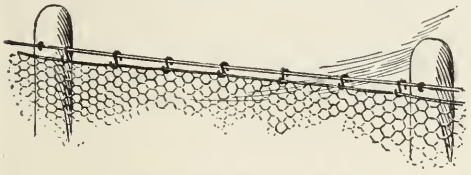
ping down over the wall. Uprights and crosspieces were used, as shown in Fig. 2, to prevent the forms from

spreading. The cement was first laid on the form and then toward the center, from each side. When the cement hardened properly, the crosspieces were loosened to allow the sides of the forms to tilt, then the wires were cut and the forms removed.

Each time the forms were moved and put in place on another part of the wall, new wires were used. In Fig. 4 is shown how bolts may be used instead of nails to hold end pieces together. The bolts will make it much easier to set up and take down the forms when changing them from one part of the wall to another.—Contributed by James M. Kane, Doylestown, Pa.

Keeping Wire Mesh from Sagging

I recently constructed a fence of wire netting in which I substituted a No. 10 iron wire for the wooden frame. The

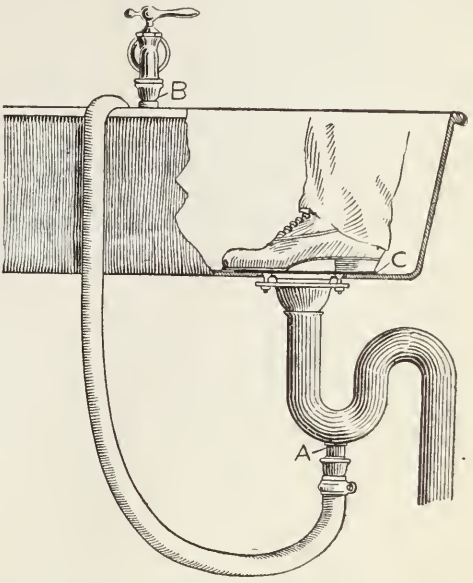


Wire Holding Up Mesh

netting is fastened to the wire at the top by means of hooks made of No. 10 wire and placed about 18 in. apart as shown in the accompanying sketch. This arrangement keeps the wire netting drawn up tight, is easier to put up, and looks better than a fence put upon a wooden frame.—E. M. Dunivant, Ft. Worth, Texas.

To Clean Sink Pipes

Sink pipes often become clogged with refuse and are hard to clean without the proper plumbing tools. The device shown in the accompanying sketch will do the work quite nicely and can be rigged up by anyone. Connect a hose pipe from the brass clean-out cap A to the faucet B, as shown. Place a sheet of rubber, C, and a block of wood over the strainer. By standing on the block of wood to hold in the water and turning on the city pressure at the faucet,

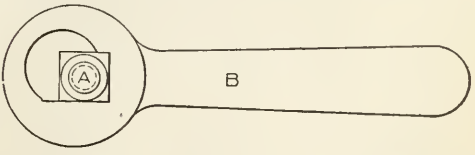


Removing the Obstruction

the obstruction can be easily washed out. If the hose can be attached to a hot water faucet, the flow of the hot water will wash out all grease that may have accumulated.—Contributed by C. G. Smith, Brooklyn, N. Y.

Substitute for a Ratchet Wrench

A common wrench can be made to operate the same as a ratchet wrench without taking it off the screw head, as shown in the illustration. A square-head cap screw is shown at A, and the wrench B is constructed so it will have all the essential gripping parts of a common wrench, yet turn around on the screw head in making



Operates the Same as a Ratchet Wrench

the backward turn. Turn the wrench over and it will remove a screw in the same manner.—Contributed by C. Purdy, Ghent, O.

Caliper for Hexagons and Squares

The tool here described is a combination caliper used to determine the exact size that a certain piece of round stock will "hex" or square. It will give in a moment's time the exact size of the full square for a tap, having given the diameter of shank. In Fig. 1, C to C_1 is exact size across flats, of the square of the shank whose diameter is A to A_1. For tool-room work it is almost indispensable and is something any mechanic can make in spare moments, says a correspondent of the American Machinist.

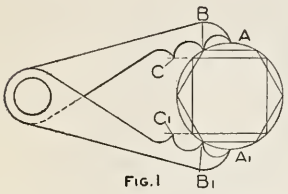


FIG. 1

Having determined the length of leg best suited to the work at hand, set a pair of sharp-pointed dividers to that measurement and describe (preferably on a sheet of tin) a circle as D-A-X-Y-Z, Fig. 2, with radius = OA, Fig. 3. Without changing the setting of the dividers, step off in the upper half of the circle, the half of the inscribed hexagon and connect these points with scribed lines as A-X, X-Y, Y-Z. Next lay off the sides of the inscribed square in the lower half of the circle as A-D, D-Z. Drop perpendiculars from the center O to the center of the sides of the inscribed hexagon OB and the square O C. These perpendiculars or distances from the center O are the measurements used, together with the radius OA, to ascertain the location of the points ABC and $A_1B_1C_1$ in the extended tool, Fig. 3.

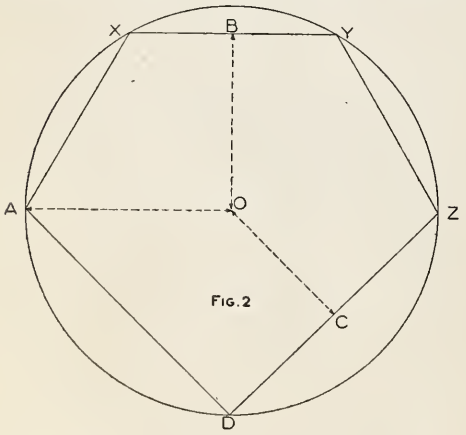


FIG. 2

FIG. 3
Layout of Tool

Care should be taken to have the three points A, B and C on each leg, all in a perfectly straight line from the outer point to the center of the pivot hole, as all six points should be in contact when the tool is closed.

To use it as in Fig. 1, set the outer points A and A_1 to the diameter of the work to be squared or "hexed" and the points B to B_1 will give the exact size the piece will "hex," while the points C to C_1 will give the size to which the piece will square.

To Harden a Hammer

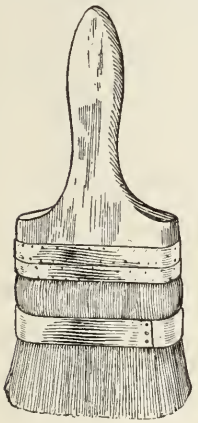
All hammers should be hardened on their striking faces only. As these are opposite each other and but a short distance apart, it would seem a difficult task, but in reality it is quite simple; the only difference from any other hardening and tempering job being that extra caution must be taken to prevent drawing the temper from the first face while heating the second. This can be done by filling the hammer eye with wet waste and keeping it wet, and by withdrawing the hammer from the fire occasionally and cooling the already tempered head in water. Thus the tempered head is kept cool and the heat confined to a short distance back from the second end or face. To temper, quench as you would with any chisel or tool, polish with emery cloth, and dip when the temper has drawn down to a light brown. Most authorities give 430° (light yellow) as the

proper color for hammer faces, but a majority of the present day hammers are softer than that, or about 450° (straw yellow). The ideal hammer is hard on the face only. The peen is usually made a little softer than the other face.

When you wish to do a first-class job of hardening of any kind, much better results will be obtained if the work is put in a piece of pipe or a special tube closed at one or both ends. The work will heat much more evenly and will come out of the fire perfectly clean and free from ashes. It will harden better, have a longer life and be much less liable to crack.—Contributed by D. A. Hampson, Middletown, New York.

Graduating the Stiffness of a Brush

The bristles of a brush can be easily changed from stiff to soft by placing a tin band snugly around the brush part so it can be readily moved up or down as desired. The bristles can be graduated to any degree of stiffness by changing the location of the band. —T. L. P.



¶The makers of shade rollers do not put in enough tacks and especially so at the ends of the rollers. It is best to put in a few additional tacks to save the annoyance of having to re-tack the shade on the roller in case of careless handling which children often give them.

Combination Compass and Dividers

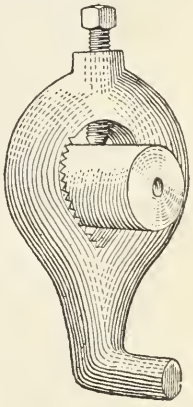
The compass shown in the accompanying photograph is made from an old buggy top brace. This compass will prove very handy in all classes of work where a great degree of accuracy is not required. The ends are cut off

Made of a Buggy Top Joint

to the desired length and then pointed. This can be done by filing or by heating and hammering them out. A notch should be filed in one leg and a brass piece brazed in so as to form a slot for the circular arm. A hole should be tapped in this brass piece for the adjusting screw. Two arms can be brazed to the other leg for holding a pencil, if desired.—Contributed by J. W. Plemons, Circleville, Ohio.

Lathe Dog with a Notched Grip

This dog is nothing more than an ordinary lathe dog with teeth or notches cut in the inner surface of the opening. The notches make it possible to hold a shaft with only a slight pressure of the screw. A shaft as large as the opening can be turned in a lathe with this dog, using a pressure from the screw, produced by turning it with the fingers.—Contributed by Chester Purdy, Ghent, Ohio.



Measuring, Marking and Cutting Rafters

As a rafter is the long side or hypothenuse of a right angle triangle, the best way to find the length is to calculate it by mensuration and then mark

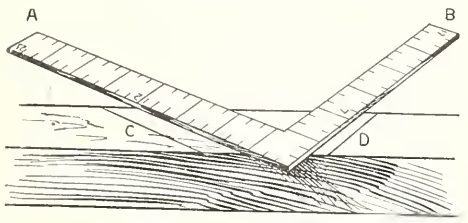


FIG. 1

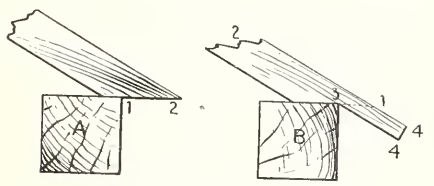


FIG. 2

Marking for Angles

each rafter at the proper angles for cutting. The length may be found by taking the square of the height of the roof, adding to it the square of one-half the width of the building, and extracting the square root of the sum. This will give the length. For example: suppose the height of the roof or gable is 6 ft. and the width of the building is 16 ft., then the square of 6 is 36, and 8 (one-half the width of the building) is 64; 36 plus 64 equals 100, and the square root of 100 is 10, which is the length of the rafter.

When the length is known, the following method may be used to mark the angles for cutting: If the roof is called a half pitch, the angle of cutting will be the same at each end, or 45 deg., and the rafters can be cut in a miter box and will fit regardless of which ends are placed together. Lay a square on the end of the rafter that is to rest on the plate of the building, as shown in Fig. 1. On the blade A let a figure represent one-half the width of the building and on the blade B let a proportionate figure represent the height of the gable. For instance, if the building is 24 ft. wide and the roof is to be 7 ft. high, lay the square with the figure 12 just to the edge of the rafter on the blade A and the figure 7 on the blade B. Make a pencil mark along the side of the blade as indicated by C. This will mark the proper angle for the lower end of the rafter. Move the square to the other end of the rafter and lay it down in the same manner and with reference to the same figures. Make a mark just outside of the blade B as indicated by D. This will be the upper angle for the top end of the rafter. This method gives the proper angle for each end of the rafter on any pitch of the roof. Always remember to have as many inches on the blade B as the roof is high in feet and as many inches on the blade A as half the number of feet the building is wide. Care must be taken to have the marks C and D the proper distance apart so that when the angles are cut the rafter will be the right length.

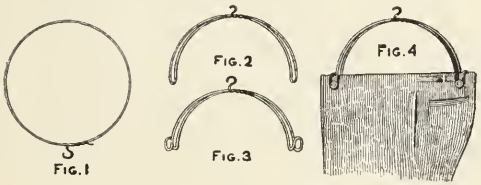
The length of the rafter and the marks for cutting can be done at the same time. This method saves calculating the length and does the measuring and marking in one operation. It will give the pitch of the roof approximately correct. While at certain pitches there may be a very slight difference in the height of the gable from what is expected, the rafters will always fit properly because they will be angled according to their strength. This method consists in laying the square as in Fig. 1, but at certain angles for different pitches, and moving the square along the rafter from mark to mark one-half as many times as the building is wide. When the square is laid on the first time, a mark is made along the side of the blade A. This mark will be the proper angle for the end of the rafter that sets on the building plate. Another mark is now made along the outside of the blade B and the square is moved along the rafter so

that the figure on A comes to this mark. This operation is done, as mentioned, one-half as many times as the building is wide in feet. The last mark made on the outside of the blade B will be the mark for cutting the top end of the rafter. When the square has been laid on the rafter the required number of times it is evident that the first and last marks will agree with the marks C and D, as shown in the illustration, and will be the proper angles and length for cutting the rafter.

The assumed projections of the opposite rafters must be taken in consideration and counted in on the width of the building to obtain the right figure to make the rafters fit properly. If the rafters are to be set on the plate as in A, Fig. 2, the width of the building must be taken from the point 2 instead of 1, and if they are set as in B, the length of the rafter must be measured from the point 1 and the width of the building taken from 1 instead of 3. The part from 1 to 4 and from 3 to 4 is regarded as an appendage—Contributed by J. G. Allshouse.

How to Make a Trouser Hanger

The hanger is made of a piece of heavy wire about 4 ft. long bent so as to form a complete circle with a hook made on one end and the other twisted about the wire at the base of the hook to hold them together, as shown in Fig. 1. The wire is then bent double, Fig. 2, and the ends turned up, Fig. 3, to make hooks for the buttons. The



Wire Trouser Hanger

spring of the wire will keep the waist band tight. The method of application is shown in Fig. 4.—Contributed by Herbert Hahn, Chicago, Ill.

Keying Foundation Timbers

There are three ways of keying one timber crosswise to another, as, for instance, in making a temporary or semi-permanent foundation for a saw-mill or other machinery, says Power and Transmission.

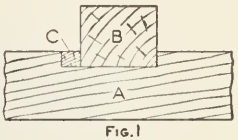


Fig. 1

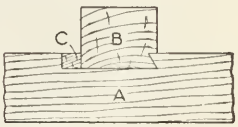


Fig. 2

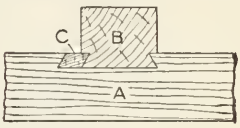


Fig. 3

The first is shown in Fig. 1, where the sill A is simply boxed out a bit wider than the cross-tie B, and the wedge or key C is rectangular. The objection to this, which of course is the easiest way, is that the tie B can lift, unless the weight upon it is very great and it can tip, if there is any great cross thrust.

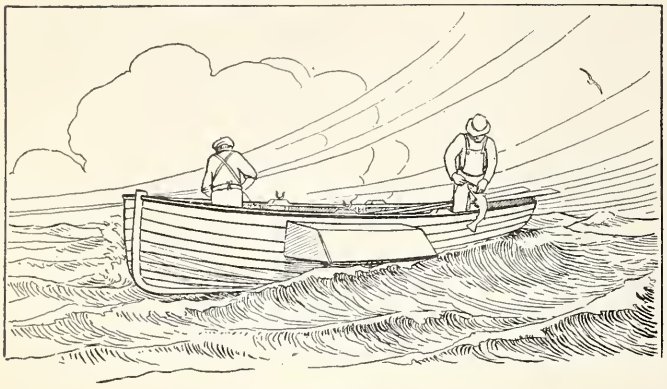
The lifting tendency is very largely overcome by making a dovetail on one side of the gain in the sill, as seen in Fig. 2. This prevents tipping to the left as seen in the sketch, but not to the right.

The best way, however, is to make the box in the sill a full dovetail, as seen in Fig. 3, and to use a rhomboidal wedge, as shown at C in the same figure. Several of these wedges can be made economically by taking a piece of wide plank, as long as the wedges are to be, and canting the saw table so as to cut it on the bevel.

Converting Quicksand into Rock

Quicksand can be made into a solid rock and save the driving of piles where it is desired to secure a good strong and lasting foundation for bridges, buildings or machinery. Take a hand or power force pump and a long pipe nozzle, and inject liquid cement into the quicksand. One bag of cement will solidify 7 cu. ft. of quicksand.

Air Lock for Boats



Air Lock on the Side of a Boat

To make a useful and efficient air lock for boats take a board about 3 ft. long, nail ends and one side to it, and fit it to the side of the boat. Make two of them, one for each side of the boat and fasten them a little above the waterline. Fasten them securely and calk with tar. With these attached, the air caught in the lock will prevent a boat from upsetting.

Finding the Gradient of a Hill

Many motorists may have wished at some time or other to find out the gradient of some hill in their neighborhood, says Automobile Topics. This can be readily done with the assistance of a level and a piece of straight timber—a lath will do. First run the car on a perfectly level floor and have the tires all pumped up to normal. The footboard should be made parallel with the floor, that is, horizontal. Obtain a piece of lath, ½ in. thick, 2 in. wide and 5½ ft. long, and have the edges planed true and straight. Fasten a small piece of wood firmly at right angles on one end of this lath. The piece should extend 2½ or 3 in. below

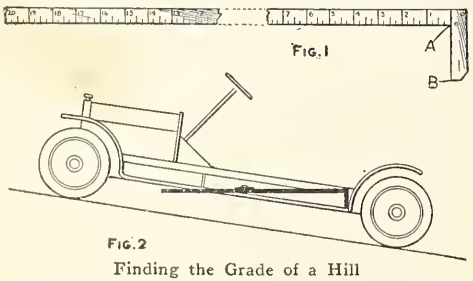


FIG. 1

FIG. 2

Finding the Grade of a Hill

the edge of the long piece. Along the bottom edge of the long arm mark off at a number of points the exact distance apart that the short arm projects below the long arm, or from A to B.

If the short arm projects 3 in., a 5-ft. long arm will give twenty readings. These can be again subdivided into as many parts as the accuracy desired may require. With this simple affair and an ordinary level, take the car to the center of the slope you wish to measure. Stop on the slope, stand the short arm on the edge of the footboard near the rear wing, Fig. 2. Place the level on top of the long arm, and when the long arm is moved to be exactly horizontal, read off the figure of the division cutting the rear edge of the footboard. This gives the slope, expressed as a fraction, viz., 1-20, 1-14, 1-17½, etc. This operation can be repeated on every change of slope, and if the surface distance between each change of slope be taped, the section of the hill can be easily plotted. If it be desired to express the slopes thus found in degrees, sufficient accuracy is obtained up to 20 deg. by dividing the denominator of the fraction into 60. Thus, a slope of ¼ equals 15 deg., 1/6 equals 10 deg., 1/8 equals 7½ deg., all approximate.

Add aluminum bronze to a white or light paint that is to be used for lettering on a dark ground.

AMATEUR MECHANICS

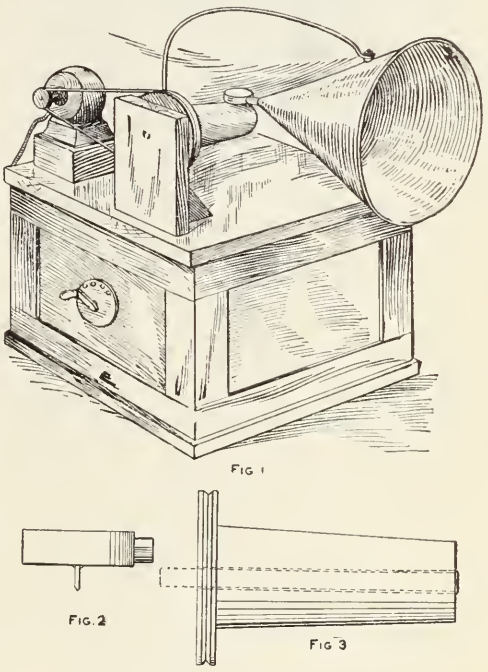
Home-Made Phonograph

Make a box large enough to hold four dry cells and use it for a base to mount the motor and a support for the revolving cylinder. Any one of the various battery motors may be used for the power. The support for the cylinder is first made and located on the cover of the box in such a position that it will give ample room for the motor. The motor base and the support are fastened by screws turned up through the cover or top of the box. The location of these parts is shown in Fig. 1.

The core for holding the cylinder wax records is made of wood, turned a little tapering with a diameter at the small or outer end of 1⅝ in., and the larger end 1⅞ in., the length being 4½ in. A wood wheel with a V-shaped groove on its edge is nailed to the larger end of the cylinder. The hole in the core is fitted with a brass tube, driven in tightly to serve as a bearing. A rod that will fit the brass tube, not too tightly, but which will not wobble loose, is threaded and turned into the upper end of the support. The core with its attached driving wheel is shown in Fig. 3. The dotted lines show the brass bearing and rod axle. The end of the axle should be provided with a thread over which a washer and nut are placed, to keep the core from coming off in turning.

The sound box, Fig. 2, is about 2½ in. in diameter and 1 in. thick, made of heavy tin. The diaphragm, which should be of thin ferrotype tin, should be soldered to the box. The needle is made of a piece of sewing needle, about ⅛ in. long, and soldered to the center of the diaphragm. The first point should be ground blunt, as shown in the sketch. When soldering these parts together, take care to have the diaphragm lie perfectly flat and not made warping by any pressure applied while the solder is cooling.

The tin horn can be easily made, attached to the sound box with a piece of rubber hose and held so it will swing the length of the record by a rod attached to the top of the box as shown. The motor can be controlled by a small three or four-point battery rheostat.—Contributed by Herbert Hahn, Chicago, Ill.

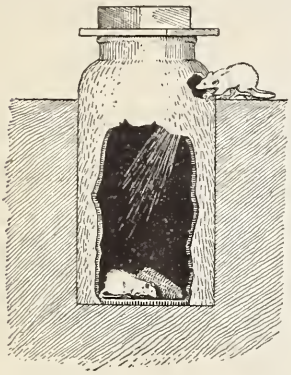


Phonograph and Construction of Parts

¶Glass doors in bookcases may be kept from swinging open by boring a hole about ¼ in. deep either at the top or bottom in the edge of the door, 2 in. from the closing edge, and inserting an ordinary cork, allowing a small portion to project and rub on the facing.

A Novel Rat Trap

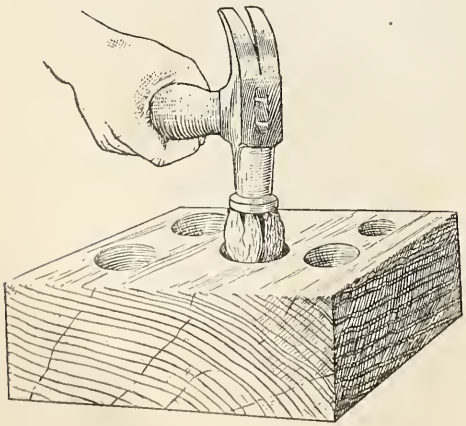
A boy, while playing in the yard close to a grain house, dug a hole and buried an old-fashioned fruit jug or jar that his mother had thrown away, says the Iowa Homestead. The top part of the jug was left uncovered as shown in the sketch, and a hole was broken in it just above the ground. The boy then placed some shelled corn in the bottom, put a board on top, and weighted it with a heavy stone.



The jug had been forgotten for several days when a farmer found it, and, wondering what it was, he raised the board and found nine full-grown rats and four mice in the bottom. The trap has been in use for some time and is opened every day or two and never fails to have from one to six rats or mice in it.

A Nut-Cracking Block

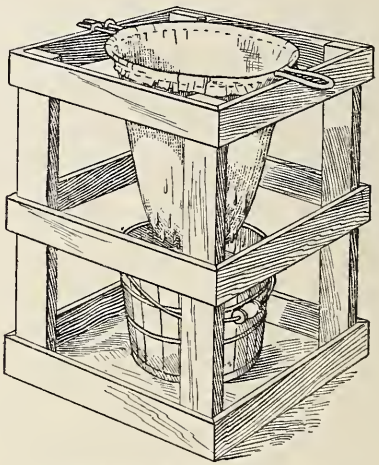
In the sketch herewith is shown an appliance for cracking nuts which will prevent many a bruised thumb. To anyone who has ever tried to crack butternuts it needs no further recommendation. The device is nothing more than a good block of hardwood with a few holes bored in it to fit the different sized nuts. There is no need of holding the nut with the fingers, and as hard a blow may be struck as desired. Make the depth of the hole two-thirds the height of the nut and the broken pieces will not scatter.—Contributed by Albert O'Brien, Buffalo, N. Y.



Holes in Block for Nuts

A Jelly-Making Stand

Every housewife who makes jelly is only too well acquainted with the inconvenience and danger of upsets when using the old method of balancing a jelly-bag on a couple of chairs stood on the kitchen table, with the additional inconvenience of having a couple of chairs on the kitchen table out of commission for such a length of time.



Cheesecloth Strainer on Stand

The accompanying sketch shows how a stand can be made from a few pieces of boards that will help jelly makers and prevent the old-time dangers and disadvantages. The stand can be stood in the corner of the kitchen, or under the kitchen table where it will be out of danger of being upset.—Contributed by Lyndwode, Pereira, Ottawa, Can.

Wood-Working for Beginners

By IRA S. GRIFFITH

CHAPTER VII—Squaring up Mill-Planed Stock

Guaging for Width

Having planed and marked the face side and face edge, the next step is to mark the desired width. Figure 36 shows the tool used for this purpose and the manner of holding it while setting it. It is called a marking gauge. Gauge sticks are marked off like a ruler into inches and fractions. These markings are so unreliable, however, that it is better not to depend upon them. Figure 37 shows the position of the gauge in action. The top of the spur is tipped forward so as to make the cutting edge enter the wood at a slight angle while the tool is being pushed

Fig. 36—Holding and Setting Marking Gauge

forward. The head of the gauge must be held against the face edge.

Planing Second Edge

The second edge is planed in a manner similar to that of the first. The gauge line limits the amount of wood that may be removed. Care must be taken, therefore, to test with the try-square as was done on the first edge while approaching the line, so that any irregularities may be corrected by the time the line is reached.

The test for straightness such as was given the first edge is not necessary here, if the gauge line has been planed properly. The first edge being straight and the second one gauged therefrom, the second edge will be straight too if the gauging has been carefully done. If there is more than

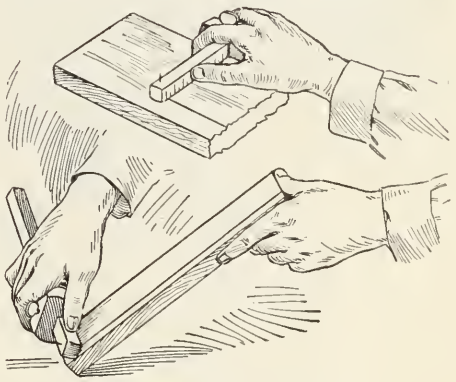


Fig. 37—Gauging for Depth

one-fourth of an inch of waste outside the gauge line it should be ripped off, cutting parallel to the line and about $\frac{3}{16}$ in. in the waste.

Planing Second Surface

Since stock that is S-2-S has the correct thickness, it is necessary in preparing this surface merely to remove the mill-marks, the smoothing plane

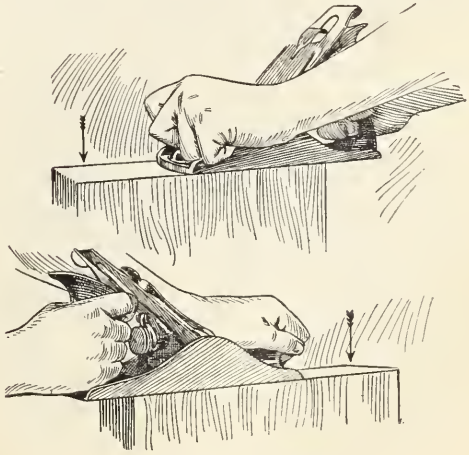


Fig. 38—End Planing

being used as described in planing up the first broad surface.

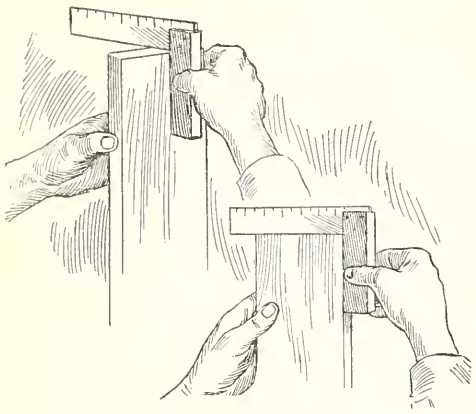


Fig. 39—End Testing

Planing First End

End planing differs from edge and surface planing in that there are no shavings, only sawdust, because the cutting takes place across the grain. Care must be taken in end planing not to sliver and break the arrises. This can be avoided by not planing entirely across the end. Plane about two-thirds of the way, then reverse and plane from the other direction (Fig. 38).

While the block plane is especially designed for doing end planing, any of the other planes may be used if a vise is at hand in which the piece of wood may be placed so as to allow both hands free for holding the plane.

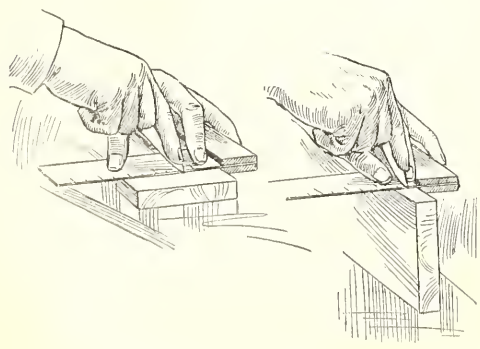


Fig. 41—Lining across Edge and Face

The Tests—The first test for accuracy in end planing is made by holding the beam of the try-square firmly against the face edge and lowering the blade until it rests upon the end of the piece of wood. By holding the piece up between the light and the eye any unevenness will be visible (Fig. 39). The second test is similar to the first except that the beam of the try-square is held against the face side instead of the face edge. Continue planing until both tests show no light between the try-square blade and the end of the wood.

Measuring the Length and Lining

From the end just squared up measure and mark the length desired, Fig. 40. With try-square and knife mark lines (Fig. 41) at this point across face side and face edge. If there is more than ⅛ in. of waste, saw it off, sawing

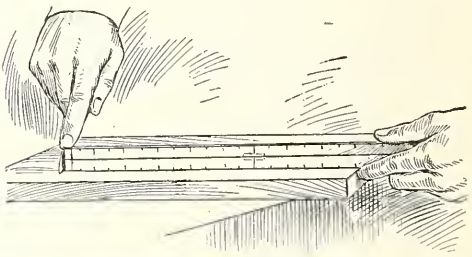


Fig. 40—Measuring Length

about $\frac{1}{16}$ in. outside and parallel to the line.

Planing Second End

The second end is to be planed to the lines just made. The two tests given the first end should be applied to the second end while approaching the lines; that the end may be square when the lines are reached.

This completes the squaring up of stock mill-planed to correct thickness.

(*To be Continued.*)

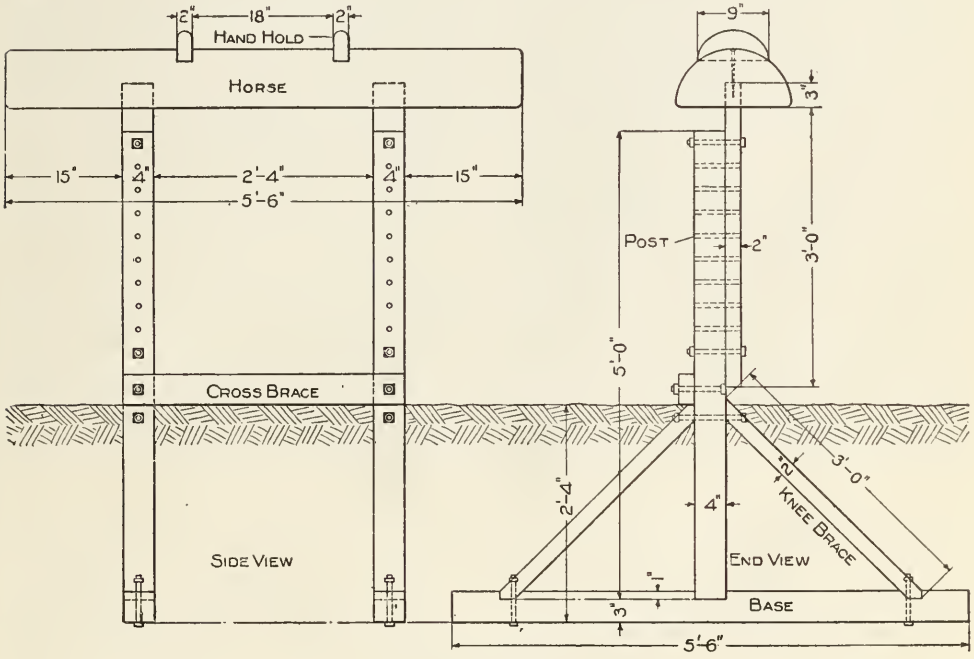
¶A piece of red string, tied to the positive wires in an ignition system, will save time and trouble.

An Outdoor Gymnasium

PART III—The Horse

The German horse is that peculiar piece of apparatus which is partly a horizontal obstruction to leap over, partly a barrier for jumps, partly a smooth surface of long and narrow dimensions over and about which the body may slide and swing, and partly an artificial back for the purpose of a peculiar style of leap frog.

The round part of this log must be planed, scraped and sandpapered until it is perfectly smooth, and free from knots, projections and splinters. Hand holds must be provided next. These are placed 18 in. apart in a central position on the horse. Make two parallel saw cuts 2 in. apart, straight down in the round surface of the horse until



The German Horse

To make a horse for the outdoor "gym" requires no difficult work save the preparation of the top or body of the horse. The making of the regular gymnasium horse requires a very elaborate wood-working and leather upholstering plant, but the one used for outdoor work can be made of a log of wood. Procure from a saw mill, wood yard or from the woods, one-half of a tree trunk from a tree 9 to 15 in. in diameter—the larger the better. The length may be anywhere from 4 to 7 ft., but 5½ ft. is a good length.

each cut is 9 in. long. Chisel out the wood between the cuts and in the mortises thus made insert the hand holds. Each hand hold is made of a 9-in. piece of 2 by 4-in. stud cut rounding on one edge. These are well nailed in place.

The body of the horse is to be fastened on top of posts so that it may be adjusted for height. It is not as difficult to make as the horizontal and parallel bars. The material required is as follows: Two posts, 4 in. square by 5 ft. long; 2 adjusting pieces, 2 by 4 in. by 3 ft. 3 in. long; 1 cross brace,

2 by 4 in. by 3 ft. long; 2 bases, 4 in. square by 5½ ft. long; 4 knee braces, 2 by 4 in. by 3 ft. long; two ½-in. bolts, 9 in. long, to fasten the knee braces at the top; ten ½-in. bolts, 7 in. long, 4 to fasten the knee braces at the bottom, 2 to fasten the cross brace and 4 to be used in fastening the adjusting pieces to the posts.

To construct, lay out the bases as shown in the drawing, making the mortises to receive the bottom ends of the posts exactly in the center, and cut a slanting mortise 6 in. from each end to receive the ends of the knee braces. Bevel the ends of the knee braces and fasten the upper ends of each pair to the post with one 9-in. bolt. Fasten the lower ends to the base with the 7-in. bolts.

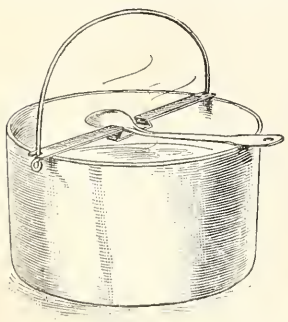
The upper end of each post should have ⅝-in. holes bored through it parallel to the base at intervals of 3 in., beginning 1½ in. from the top and extending down its length for 2 ft. 4½ in. The adjusting pieces are to be bored in a similar manner after which they are to be mortised into the under side of the horse top 15 in. from each end, and secured with screws put through the top and into the end of the adjusting pieces.

The bases with their posts and knee braces are buried 2 ft. 4 in. in the ground, parallel to each other and the same distance apart as the adjusting pieces are mortised in the horse top. When the ground has been filled in and tamped hard, the cross brace should be bolted in position with its lower edge resting on the ground and connecting the two posts.

The height of the horse from the ground is adjusted by changing the bolts in the different holes connecting the two adjusting pieces with the two posts. Much pleasant and healthful gymnastic exercise can be had in competitive horse jumping and leaping, the handles providing a way to make many different leaps through, over and around, including not only those made to see who can go over the horse from a standing or running start at the greatest height, but who can go over at the greatest height when starting from the "toeing off mark" farthest away from the horse. This horse should be located on level ground having smooth space about it for several feet.

Spoon Rest for Kettles

A rest for keeping spoons from slipping into kettles can be made from a strip of metal bent as shown in the illustration. The spring of the metal will make it easy to apply to the kettle. The spoon placed in the rest will drain back into the kettle. The cover can be placed on without removing the spoon.—Contributed by W. A. Jaquythe, Richmond, Cal.



Reason for Bursting of Gun Barrels

Gun barrels do not burst without a cause and usually that cause is one of which the shooter is entirely ignorant, but nevertheless, no one is responsible but himself, says the Sporting Goods Dealer. Gun barrels can only burst by having some obstruction in the barrel or by overloading with powder. Any gun barrel can be burst by misuse or by carelessly loading smokeless powder, but no barrel will burst by using factory loaded ammunition, provided there is no obstruction or foreign substance inside the barrel. When a gun barrel bursts at the breech or chamber, it is caused by an overloaded shell, and when it bursts in the center or near the muzzle, it is caused by some obstruction, such as a dent, snow, water, etc.

How to Make a Wireless Telegraph Set—Part IV

By Arthur Moore

Spark Coil Construction

In order to use your spark coil for experimental and wireless work you will need some form of a spark gap. A very simple one, that can be mounted in the plates attached to the top of the containing case of the coil, can be made as follows:

Procure two pieces of $\frac{5}{16}$-in. brass rod, each about 5 in. long, and thread both ends to a distance of about ¼ or $\frac{5}{16}$ in. Now turn from some hard wood two pieces similar to the one whose cross-section is shown in Fig. 1. These pieces should have a $\frac{5}{16}$-in. hole drilled through them and the brass rods forced into the holes, the rods being held in place by a small brass pin, P, placed in a hole drilled through the brass and wood as shown in Fig. 1. Obtain two brass balls about 1 in. in diameter. Drill a $\frac{3}{16}$-in. hole through each of them. At a right angle to this hole drill a second hole half way through ¼ in. in diameter, and the remainder of the way ⅛ in. in diameter. Tap the larger end of this hole so the balls can be screwed on the ends of the brass rods. The smaller end should also be threaded or a small piece of brass rod with threaded end soldered into it that can be used in mounting a binding-post as shown in Fig. 2. Obtain two pieces of $\frac{3}{16}$-in. brass rod each about 7 in. long. Turn from some hard wood two handles as shown in Fig. 3. Drill a $\frac{3}{16}$-in. hole in the small end of these handles to a depth of at least 1 in. and force the brass rods in place. The other end of the brass rods should be threaded for a short distance. These rods can be passed through the openings in the balls and held in place by means of a set screw, S, as shown in Fig. 4. The spark gap proper can be adjusted by moving one or both of these rods. Small brass balls or pieces of zinc can be screwed on the threaded ends of the rods to form the terminals of the gap.

The spark coil is now complete with the exception of an interrupter for the primary circuit. It is impossible to use the ordinary alternating current in the primary as its frequency is too low to produce the required number of reversals in the secondary. There are three different types of interrupters that are used in wireless telegraph circuits. These are the electrolytic, the mercury, and the vibrating spring types.

The electrolytic interrupter consists of a vessel containing a solution of dilute sulphuric acid with two terminals immersed in this solution. The positive terminal or anode is made of platinum and should have a surface of about $\frac{3}{16}$ in. The negative terminal or cathode is made of lead and should have an area of something like 1 sq. ft. When this interrupter is connected in series with the primary of an induction coil and a source of electromotive force of about 40 volts, the circuit will be interrupted, due to the formation and collapse of bubbles on the platinum electrode.

The mercury interrupter, which is no doubt the one most commonly used in commercial wireless stations, is capable of making interruptions as high as 10,000 per second. This interrupter consists of an iron vessel with a vertical steel shaft mounted in it and arranged to be driven at a very high speed by a small motor. Attached to this spindle is small worm or centrifugal pump. Above this pump there is mounted on the shaft a small nozzle that is connected to the outlet from the pump. When the spindle is rotated the mercury is raised to the nozzle and thrown outward against the side of the vessel.

There is mounted in the side of the vessel a small insulated piece of metal which forms one terminal of the circuit that is to be interrupted, while the iron vessel forms the other terminal. By varying the length of the insulated

segment and the speed of the shaft, the number of interruptions can be adjusted to the desired value.

The vibrating spring type of interrupter is no doubt familiar to almost every one, it being practically the same as the ordinary vibrating bell. Its operation is very satisfactory when properly constructed and adjusted.

The construction of the mercury interrupter is rather difficult and the electrolytic interrupter requires 40 volts or more to operate it so that you had better construct the vibrating spring type.

The principle of the spring interrupter is shown in Fig. 5. When a current is passed through the circuit by connecting a battery or some other source of electromotive force to the terminals T_1 and T_2, the iron core I of the coil C becomes magnetized and attracts the soft iron armature A, which is mounted on the spring S. When this armature A is drawn toward the iron core I the contact K is broken and the core of the coil C becomes demagnetized, due to the fact that no current is flowing in the circuit, thus allowing the armature A to return to its initial position and again complete the contact K, and the same operation is again gone through. The winding C may be the primary winding of the spark coil or it may be an entirely different winding as shown in Fig. 6, the make and break contact for the primary circuit being an additional one mounted on the spring S, as shown at K_1. This second type of construction has the advantage that it can be used with any coil, while the other type is mounted rigidly to one particular coil.

The following description is that of a vibrator as shown in Fig. 5, with a little change, and will serve your purpose. All the care that you may exercise in the construction of your coil will give results far below those anticipated, if the vibrator is of poor design. The simple vibrator shown in Fig. 6 should have the following modification to make its operation the best. The make and break contact is not mounted upon the main spring S, but upon a second spring S_1 whose movement is controlled by S through the screw H, Fig. 8. This screw H passes through a hole in S_1 a little larger in diameter than the screw itself and screws into S. With this arrangement the division of the time between the make and break of the circuit is better made.

First procure some ⅛-in. brass and cut a piece to correspond to the dimensions given in Fig. 7. Drill the holes in this piece as indicated. Bend the part P at the dotted line until it is at right angles to the remainder of the piece.

Procure a piece of spring brass, 3⅛ in. long, 1 in. wide and $\frac{1}{32}$ in. thick, that is to form the spring S, Fig. 8. Round off the upper end of this piece and drill the holes as indicated in Fig. 9. The spring S_1 should be made from some spring brass 1/64 in. thick and its other dimensions should corrrespond to those given in Fig. 10. Drill the holes indicated in the figure and fasten a small piece of platinum in place at the point K.

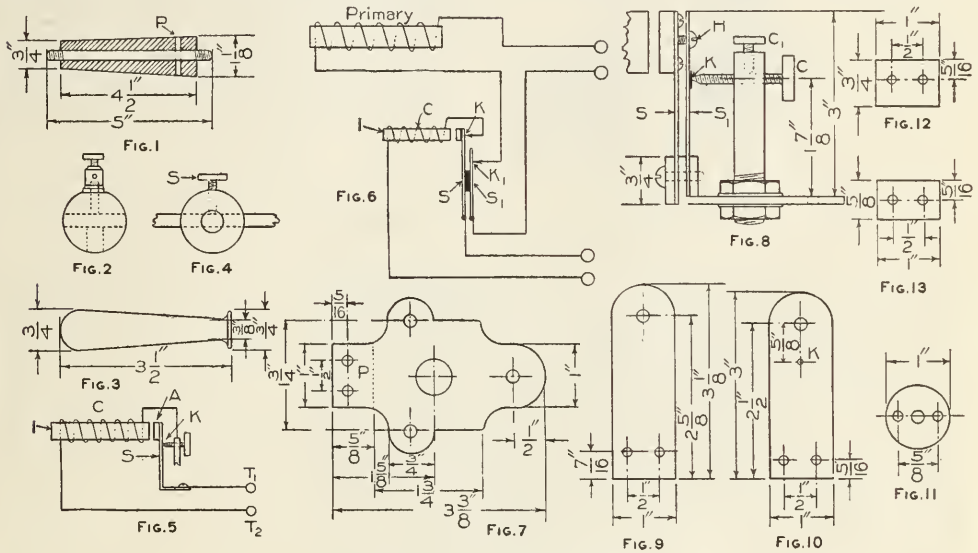
Cut from a round bar of soft iron, 1 in. in diameter, a piece ¼ in. long and drill three holes in it as shown in Fig. 11. These holes should be threaded to take machine screws. This piece can now be mounted on the upper end of the spring S with two small screws.

Cut two pieces from some ⅛-in. brass whose dimensions correspond to those given in Fig. 12 and Fig. 13. Tap the two holes in the piece shown in Fig. 12. These two pieces are to be used in mounting the springs S and S_1 upon the base of the vibrator as shown in Fig. 8.

The support for the screw C, Fig. 8, can be made from some ½-in. brass rod. Take a piece 2¾ in. long and thread one end for a distance of ¾ in. Drill a hole ¼ in. from the other end and thread it to take the screw C which should be about $\frac{3}{16}$ in. in diameter. Drill a second hole in the end of the rod and thread it to take the screw C_1, Fig. 8, that is to hold C in place after it is once adjusted. Another hole should be drilled in the threaded end of the rod

and a piece of No. 14 gauge copper wire about 12 in. long soldered into it to be used in making connections to the vibrator. Make two nuts $\frac{3}{16}$ in. thick to fit the thread cut on the rod, one rubber bushing to fit the large hole in the base of the vibrator with an opening in it ½ in. in diameter, and two washers of insulation material, 1 in. in diameter and $\frac{1}{16}$ in. thick with openings in them ½ in. in diameter. The support for C can then be fastened to the base as shown in Fig. 8. The vibrator is now complete and can be mounted on the case of the coil. A small wooden block should be provided of sufficient thickness to place the armature A on the same level as the end of the core of the coil. Place the end of a piece of No. 14 gauge copper wire under one of the screws used in mounting the base, and pass it through a hole in the top of the lower case, and solder the other end to the binding-post B_3. (See Fig. 7, Part III.) The wire that was soldered to the support for C should also be soldered to the binding-post B_4. The primary winding is connected to the binding-posts B_5 and B_6. The condenser can be connected across the contact of the vibrator by short pieces of wire as previously described.

Assuming that all connections have been made as directed and that the construction of the various parts is complete, you can make the final adjustment as follows: Connect 12 dry cells in series to the posts B_5 and B_6. Adjust the spark gap to about ½ in. and the condenser to maximum capacity. Turn the screw C up until it completes the circuit and the vibrator is started. You should now vary the tension in the screw H, the position of the screw C and the capacity of the condenser until you obtain the maximum spark. This adjustment is a matter of trial, becoming easier as you operate your coil.



Spark Gap and Vibrator Details

(*To be Continued.*)

How to Remove Glass Stoppers

Glass stoppers often stick in decanters and are very hard to remove. They can be withdrawn easily by winding a string several times around the neck of the bottle, then by taking hold of the loose ends, and drawing the string rapidly back and forth. The friction caused by the string will heat the glass and cause it to expand, thus releasing the grip on the stopper.—Contributed by A. A. Houghton.

Telescope Stand and Holder

With the ordinary small telescope it is very difficult to keep the line of sight fixed upon any particular object. To meet the situation I constructed the

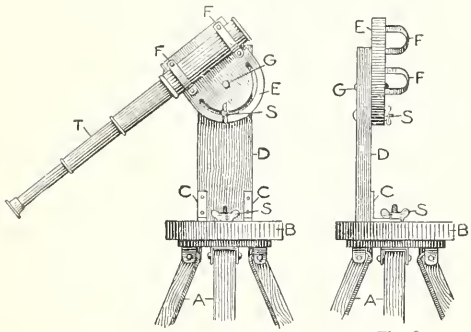


Fig. 1 Fig. 2

Made of a Camera Tripod

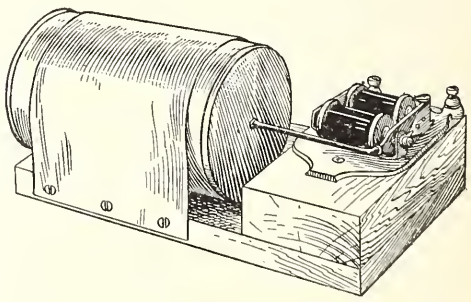
device illustrated herewith. A circular piece of wood, B, 6 in. in diameter, is fastened to a common camera tripod, A, with a set screw, S. Corner irons, CC, are screwed to the circular piece. These corner irons are also screwed to, and supported in a vertical position by the wood standard D, which is 4 in. wide and of any desired height. To this standard is secured the wood shield-shaped piece E by the screw G upon which it turns. A semi-circular slit is cut in the piece G, through which passes the set screw S. The telescope is secured to the piece G by means of the pipe straps FF. Rubber bands are put around the telescope to prevent rubbing at the places where the straps enclose it.

The wood pieces were made of ½-in. mahogany well rubbed with linseed oil to give them a finish. The corner irons and set screws or bolts with thumb-nuts can be purchased at any hardware store. The pipe straps of different sizes can be obtained from a plumber's or gas and steam fitter's store. With this device, either a vertical or a horizontal motion may be secured, and, after bringing the desired object into the line of sight, the set screws will hold the telescope in position. Any one owning a tripod can construct this device in three or four hours' time at a trifling cost. In Fig. 1 is shown the side view of the holder and stand, and Fig. 2 the front view.

It may be of interest to those owning telescopes without solar eyepieces to know that such an eyepiece can be obtained very cheaply by purchasing a pair of colored eyeglasses with very dark lenses and metal rims. Break off the frame, leaving the metal rims and nibs at each end. Place these over the eyepiece of the telescope and secure in place with rubber bands looped over the nibs and around the barrel of the instrument.—Contributed by R. A. Paine, Richmond, Va.

How to Make an Electrical Horn

Secure an empty syrup or fruit can, any kind having a smooth flat bottom will do. If the bottom is not perfectly flat, it will interfere with the regular tone vibrations, and not produce the right sound. Remove the label by soaking it in hot water. Take an ordinary electrical bell and remove the gong, clip off the striking ball and bend the rod at right angles. Cut a block of wood ¾ in. thick, 5 in. wide and 8 in. long for the base. Fasten the can on it with a piece of sheet brass or



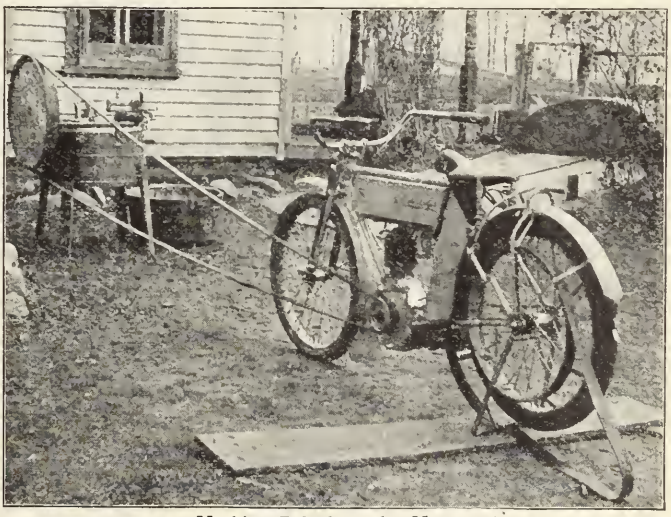
Tin Can and Bell Parts

tin as shown in the sketch. Mount the bell vibrator on the base, using a small block of wood to elevate it to the level of the center of the can, and solder the end of the vibrator rod to the metal.

Connect two dry cells to the bell vibrator, and adjust the contact screw until a clear tone is obtained. The rapidly moving armature of the bell vibrator causes the bottom of the can to vibrate with it, thus producing sound waves. The pitch of the tone depends on the thickness of the bottom of the can. This horn, if carefully adjusted and using two cells of dry battery, will give a soft pleasant tone that can be heard a block away. If the two projecting parts of the vibrator are sawed off with a hacksaw, it can be mounted on the inside of the can. This will make a very compact electric horn, as only the can is visible.—Contributed by John Sidelmier, La Salle, Ill.

Driving a Washing Machine with Motorcycle Power

The halftone illustration shows how I rigged up my washing machine to be driven by the power from my motorcycle. I made a wheel 26 in. in diameter of some 1-in. pine boards, shrunk an iron band on it for a tire, and bolted it to the wheel on the washing machine. A long belt the same width as the motorcycle belt was used to drive the machine. The motorcycle was lined up and the engine started, then the motorcycle belt thrown off and the long belt run on, connecting the engine and washing machine wheel. —I. R. Kidder, Lake Preston, S. D.



Machine Belted to the Motorcycle

Home-Made Aquarium

A good aquarium can be made from a large-sized street lamp globe and a yellow pine block. Usually a lamp globe costs less than an aquarium globe of the same dimensions. Procure a yellow pine block 3 in. thick and 12 in. square. The more uneven and twisted the grain the better for the purpose, as

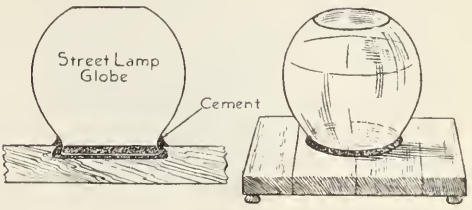


FIG. 1 FIG. 2

Lamp Globe as an Aquarium

it is then less liable to develop a continuous crack.

Cut out a depression for the base of the globe as shown in Fig. 1. Pour in aquarium cement and embed the globe in it. Pour more cement inside of the globe until the cement is level with the top of the block. Finish with a ring of cement around the outside and sprinkle with fine sand while the cement is damp. Feet may be added to the base if desired. The weight of the pine block makes a very solid and substantial base for the globe and renders it less liable to be upset.—Contributed by James R. Kane, Doylestown, Pa.

¶Never allow lard oil to harden on a lathe.

FIG. 1

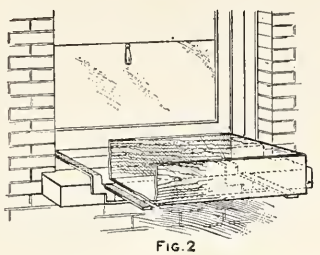


FIG. 2

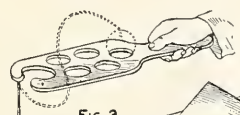


FIG. 3

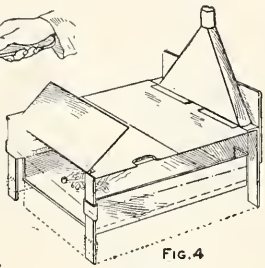


FIG. 4

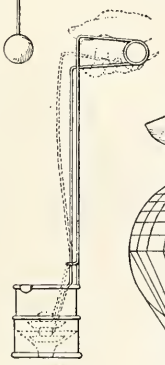


FIG. 5

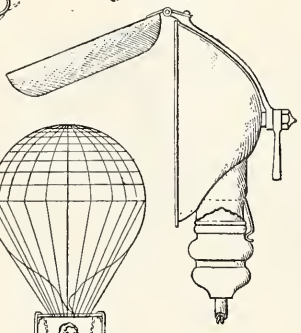


FIG. 6

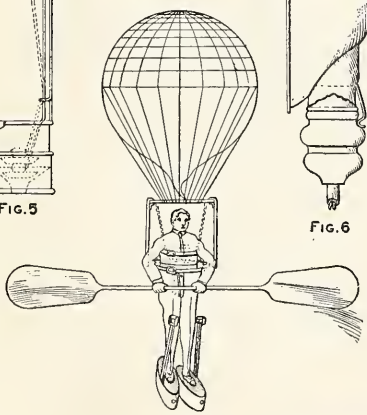


FIG. 7

FIG. 8

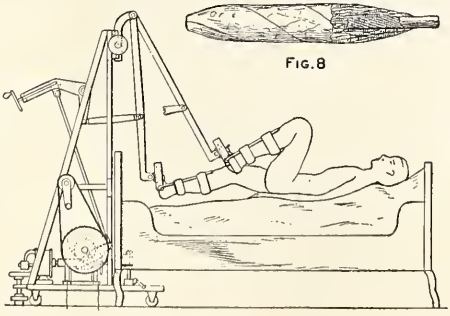


FIG. 9

INTERESTING PATENTS,

COMBINED SNAP-HOOK AND SWIVEL—Figure 1 is an interesting combination of snap-hook and swivel. It consists of a hook having its mouth on one side and a tubular shank at one end. The grooved roller, mounted on a stem which rotates in the shank, guards the mouth of the hook.

WINDOW-BOX SUPPORT—The problem of securely fastening window-boxes to stone window ledges is often hard to solve, but with this bracket device (Fig. 2) it becomes very simple. The inner ends of the brackets are screwed fast to the wooden sill.

PERFORATED-PADDLE BALL GAME—The object of this perforated-paddle ball game (Fig. 3) is to toss the ball on the end of its rubber leash in such manner as to land it in one of the holes provided. The largest count is gained by first succeeding in jerking the ball up through the hole at the end of the paddle and then depositing it in one of the other holes.

FOLDING CAMP STOVE—Figure 4 illustrates a camp stove that can be folded up for transportation purposes and carried in a small space. The firebox is removable and adjustable to the legs supporting the top of the stove. The legs are removable from the top piece, as are also the wind shield shown at the front and the stovepipe base at the rear.

COMBINED DIPPER AND FUNNEL—Transferring liquids from pots, pans, or tanks, usually requires two implements, a dipper and a funnel, but this arrangement (Fig. 5) combines the two in one. A valve at the lower end of the plunger seats over the discharge hole when dipping, but when the plunger is lifted this valve allows the liquid to fall through.

COMBINED REFLECTOR AND SHADE—Many kinds of intricate work require a strong reflector, yet the eyes must not be blinded with the glare. Consequently, the reflector shown in Fig. 6 is provided with a shade that not only protects the eyes but aids in throwing a powerful stream of light downward upon the object being worked upon. It is adjustably mounted so that it can be swung downward or to either side, the whole forming a double reflector.

UNIQUE BALLOON-FLYING-MACHINE—In the past, when aerial flight was still a dream, such ideas as the one here illustrated (Fig. 7) were put forth as solutions of the problem, but today, when aerial flight is a fact, machines of this order seem out of place. The means of buoyancy are a balloon, and auxiliary buoyant bodies located just under the feet. The operator stands or hangs upright, supported by a sling and saddle. Propulsion is by means of a double-ended paddle.

SMOKE FILTER FOR CIGARS—In this day of filtering and sterilization it is not unnatural that such a unique idea as this for the removal of the impurities from tobacco smoke has been given birth. The filter which is shown in Fig. 8, is formed of layers of blotting paper and cotton texture, provided with an envelope of water-proof paper. It is inclosed in the end of the cigar when the latter is rolled, and all the smoke drawn into the mouth passes through it.

MOVEMENT-CURE APPARATUS—The belief that compulsory movement of the limbs, when the patient is too weak to exercise them without aid, is a great help in effecting a cure in certain diseases or under certain conditions, has led to the designing of the apparatus illustrated by Fig. 9. The patient's lower limbs are made fast to the oscillating arms of the apparatus, which are operated at any speed desired by the turning of a crank.

SWEAT SHIRT FOR HOT WEATHER WEAR—This remarkable openwork shirt (Fig. 10) is an undergarment for exceedingly warm weather, or for men employed in high temperatures during any period of

PRACTICAL OR UNIQUE

the year. It consists of strips arranged in network form, with pieces of cork passing through and protruding from each side. These regularly spaced corks keep the garment spaced from the wearer's body and also from any outer garment that may be worn over it.

CLOTH-HOLDER FOR BROOMS—The cloth shown attached to the broom in Fig 11 is held in place by means of a pair of U-shaped clamps designed for the purpose. They engage over opposite sides of the handle, pivots connecting the overlapping ends. The teeth on the upper sides of the clamps bend inward and secure the cloth against slipping.

PULSATING DEVICE FOR MILKING APPARATUS—Figure 12 shows a pulsating device that has been devised to give as perfect an imitation of the suckling operations of a calf as possible. The pulsator is connected between the service and pump pipes of the milking apparatus, and is provided with a valve subject to the drawing force or partial vacuum of the system. A controller, provided with connections for effecting the movement of this valve, cuts off and opens the air communication, thus providing pulsations.

DEVICE TO TEACH SWIMMING—A mechanical device for teaching persons to swim is illustrated in Fig. 13. It is a framework support provided with front and rear pulleys, elastic cables, and means for regulating the strokes of both arms and legs. The cable drawn out from the frame by the outward stroke of the left arm draws the right leg through the proper swimming movement, and the movement of the right arm applies the same action to the left leg. The elastic cable underneath the frame restores the limbs of the pupil to their initial position after each movement. Means are provided to prevent a downward stroke of the arms and to limit the downward stroke of the legs.

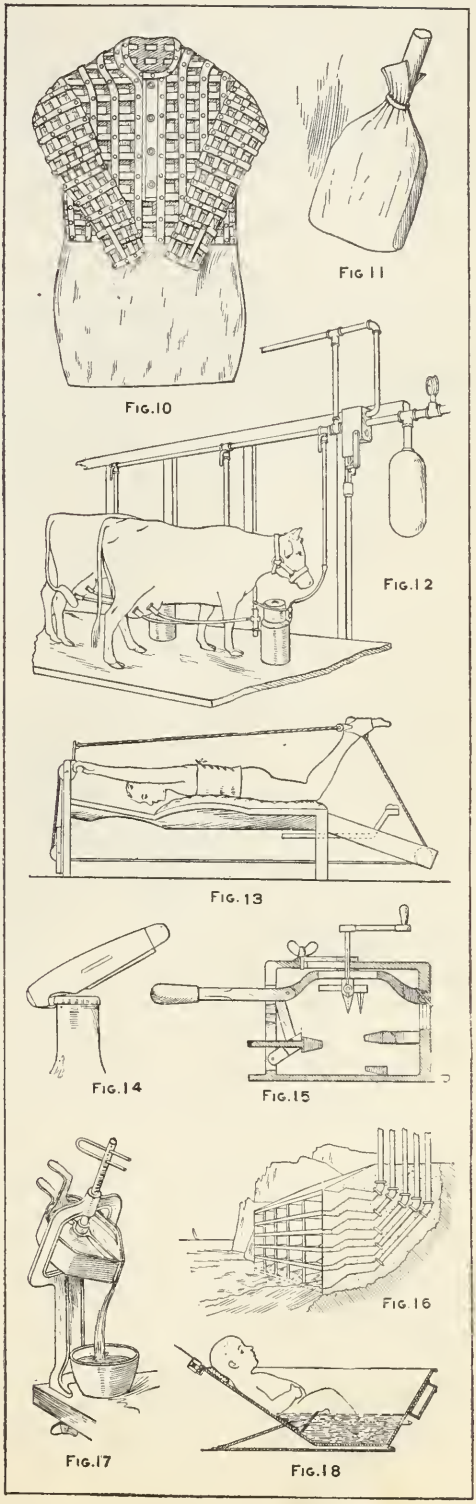
COMBINED KNIFE AND BOTTLE-OPENER—A more practical combination of a knife with some other tool than the one here illustrated (Fig. 14) would be difficult to devise. Such liquid refreshments as pop, ginger ale, grape juice, and like beverages, as well as nearly all aperient waters, are now corked with the metal bottle closer.

IMPROVED CAN-OPENING DEVICE—The can-opening machine shown by Fig. 15 is designed for rapid work. The can is first gripped solidly in the framework of the device, then the handle is pushed down, forcing the blades of the cutter through its top near the edge. A turn of the handle above the frame causes the cutter to make a complete circle.

METHOD OF COMPRESSING AIR BY MOVING WATER—A method of compressing air through the action of the waves is illustrated by Fig. 16. The compressor consists of a series of cells, each cell having an open end directly facing the body of water. The inward rush of the waves drives air into the cells, and this air is carried by pipes into a tank. Valves are provided in the pipes to allow the air to enter the tank when driven by sufficient force, but do not allow air to escape.

MEAT AND FRUIT PRESS—Figure 17 illustrates a press designed for the extraction of the juices of meat or fruit. The substance to be pressed is placed in the body of the machine, which is shaped very much like a flat-iron, and the turning of the press forces the juice out at the pointed end, where it falls into a cup or other receptacle.

INFANT'S BATHTUB—The portable bathtub shown in Fig. 18 has one exceptionally slanting end, provided with a base extension to give it solid support. A rubber seat and head-rest are provided on the slanting portion so that the infant can be laid down during the bathing operation instead of having to be held.



THE navigating officer: "Admiral, the enemy's fighting airship has been sighted above the western horizon."

The admiral: "Call all hands to quarters. Hoist the grenade proof netting over the quarter deck. Raise the steel roof screens above the magazines. Spread the rubber sheathing aft. Get out the aeroplane destroyers. Fill the tubes with slugs and nails. Couple on the fire hose. He may drop nitroglycerin. Don't forget to have a crew of trusty men to work the shifting caps over the mouths of the smokestacks. And, Billinger——"

"Aye, aye, sir."

"Order up my triple steel helmet and upholstered shoulder pads. That fellow may drop oranges."

"Aye, aye, sir."—Cleveland Plain Dealer.

◆ ◆ ◆

"Now, in order to subtract," the teacher explained, "things have always to be of the same denomination. For instance, we couldn't take 3 apples from 4 pears, nor 6 horses from 9 dogs."

"Teacher," shouted a small boy, "can't you take 4 quarts of milk from 3 cows?"

◆ ◆ ◆

A very dirty boy attended a certain school. One day the teacher sent the boy's mother a note saying that he was not clean and that she ought to bathe him oftener.

The mother sent the teacher a note in reply, in which she said:

"My boy Bill ain't no rose. Don't smell him; learn him."

◆ ◆ ◆

Merton—"I'm going in for athletics now."

Burton—"Yes?"

Merton—"I roll all of my cigarettes myself now."

◆ ◆ ◆

"Yes," said the man in the mackintosh, "I once paid to see a professional rainmaker perform."

"Where?" queried the man who had his feet on the table.

"Out in Arizona. It took place in a baseball park, and the admission was 25 cents. There was a big crowd, too."

"Did he make it rain?" asked the man with the green goggles.

"He did not."

"Did you get your money back?"

"No; he gave us dry weather checks."

◆ ◆ ◆

Tall Man (at seashore)—He said anybody could manage a sailboat.

Thin Man—He did—what then?

Tall Man—His funeral is tomorrow.—Maine Journal.

◆ ◆ ◆

"Prisoner at the bar," said the portly, pompous and florid magistrate, "you are charged with stealing a pig—a very serious offense in this district. There has been a great deal of pig-stealing, and I shall make an example of you, or none of us will be safe."—London Daily News.

◆ ◆ ◆

"What's your order, sir?" asked the waiter.

"Bring me," said the wild-eyed customer, "some medium-boiled potatoes and some eggs with the jackets on."

"Sir?"

"I don't know whether I've got that right or not, waiter," said the wild-eyed man, "but do the best you can with it. A big red automobile had to jump out of my way about two minutes ago to keep me from running over it, and I'm a bit flustered."—Chicago Tribune.

◆ ◆ ◆

"How do you know when your husband forgets to mail the letters you give him?" "I always put a card addressed to myself among 'em. If I don't get it the next day, I know. And it only costs a cent."—Cleveland Leader.

Green Purchaser (in automobile warerooms)—My friend sent me here to get a rheumatic tire.

Clerk—Rheumatic? You mean pneumatic, don't you?

Green Purchaser—Perhaps it is pneumatic. I thought it was called rheumatic because it's swelled.

◆ ◆ ◆

"The automobile bids fair to change history, even natural history," said W. B. Rogers, the motoring expert, at a dinner in New York.

"A school teacher the other day was examining a class about Col. Roosevelt's African trip, especially about the specimens shot.

"Thinking of the rhinoceros, the teacher said to a dull, sleepy-looking boy:

"'George, what did they find in Africa that is very large, that is very dangerous to approach, and that has a horn?'

"'An automobile, Ma'am,' said George promptly."

◆ ◆ ◆

"Our fleet of torpedo destroyers seems to have stirred up our friend, the enemy," remarked the naval chief of one great power.

"Yes," replied his assistant, "it is said they will build a fleet of torpedo destroyer exterminators now."

"Let 'em; we'll build a fleet of torpedo destroyer exterminator annihilators."—The Fleet Review

◆ ◆ ◆

The following answers are taken from a number collected by a teacher in the Topeka schools:

"A blizzard is the inside of a hen."

"Oxygen is a thing that has eight sides."

"The cuckoo never lays its own eggs."—Indianapolis News.

◆ ◆ ◆

The crew of a way freight had discovered on the right of way a cow which they took to be dead, and the conductor had, by wire, so reported to the superintendent. The latter, anxious to get the facts of the case, immediately wired as follows to the section foreman on whose territory the animal was seen:

"Pat Ryan, foreman, Section 24.

"Wire complete report on cow killed on right of way near MP 45 Sec 24."

Pat got the wire all right and immediately started out to find the animal and investigate. He found her, and, after carefully viewing the "remains," sent one of his men back to the telegraph office with his answer to the "super." The answer read:

"Mr. Blank, superintendent.

"Cow killed by train wasn't killed by train. She died of eating raw buckwheat, but she ain't dead yet. If she dies before morning I'll bury her tonight. She was a good looking cow, too.

Ryan, Foreman Sec 24."

◆ ◆ ◆

Edna, who had been taught to report her misdeeds promptly, came to her mother sobbing penitently.

"Mother, I broke a brick in the fire-place."

"Well, that is not very hard to remedy. But how on earth did you do it, child?"

"I pounded it with father's watch."

◆ ◆ ◆

"Now, guard," said an eminent novelist, "remember if I have this compartment all to myself for the entire journey you will receive half-a-crown from me." "Very good, sir!" replied the guard, and he locked the door. All went well till they got to a certain station where an irascible gentleman pulled at the door of a locked compartment. "Guard! Guard!" he called. "Open this door! I've got the same right to travel in this carriage as anybody else, and I mean to do it!" The guard hurried up, whispered a few words to the irascible gentleman, who went quietly away to seek room elsewhere. "How did you manage it?" asked the author at the end of the journey, as he pressed the promised half-crown into the guard's hand. "How did you manage to get that bad-tempered old chap to go away so quietly?" "Oh, that was easy, sir!" replied the guard. "I told 'm you were a bit wrong in the 'cad!"

DOGS AS RED CROSS SCOUTS

The value of well-trained dogs of the Red Cross Service in the succor of the wounded, especially at night, has been well demonstrated by the work done by such dogs in recent maneuvres of the German and French armies.

The Red Cross in France has a department for the special training of dogs, and through its efforts the canines are taught to search out the wounded and draw attention to their location. Untiring work has trained them not to bark or howl when coming upon a wounded soldier, but to retrieve some object belonging to him and carry it to the first Red Cross worker that can be found. When the worker takes the object from the dog's mouth, the animal turns about and leads the way back.

French Red Cross Dog Retrieving a Hat

This Dog Found Nothing Lighter than the Gun

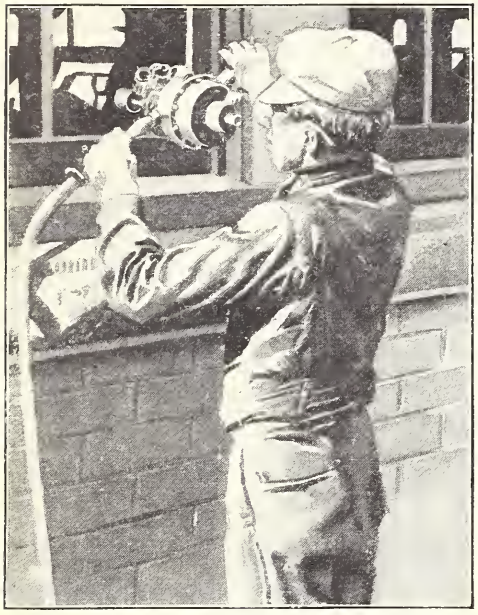
German Dog Barking for Help

On the other hand, the dogs trained for the same work in the German army, stay by the wounded soldier and bark or howl until aid arrives.

¶The Suez Canal Company has announced that, beginning Jan. 1, 1911, its rates for transit through the canal will be $1.40 per ton for freighted ships and 91.6 cents per ton for ships in ballast, a slight reduction in the existing tariff.

AIR-MOTOR FOR WINDOW-CLEANING

Cleaning the windows of stores or residences is a simple task compared



Window-Washer Driven by Compressed Air

with the keeping clean of factory and machine shop windows, yet the operator shown in the accompanying illustration does not find the work difficult, owing to the tools at his disposal. He is using an air motor, in the socket of which a stiff brush is held. The brush is dipped in benzine almost as often as the ordinary window-cleaning sponge is dipped in water, and then run over the glass. After the glass has dried, a soft, dry brush is used for polishing.

TRANSCONTINENTAL RAILWAYS OF THE WORLD

Of all the world, Africa and Australia are the only continents not yet crossed by a through railroad, but such a system is soon to be commenced in Australia.

The first transcontinental railroad in the world was the Union Pacific, completed a little more than 40 years ago. Since that time six lines have been built across the Rocky mountains in this country. Canada has one transcontinental line, and another is under construction; Mexico has one, and the trans-Andean line across South America, connecting the Atlantic and Pacific oceans, is now in operation. The trans-Siberian railway forms a through line across Europe and Asia.

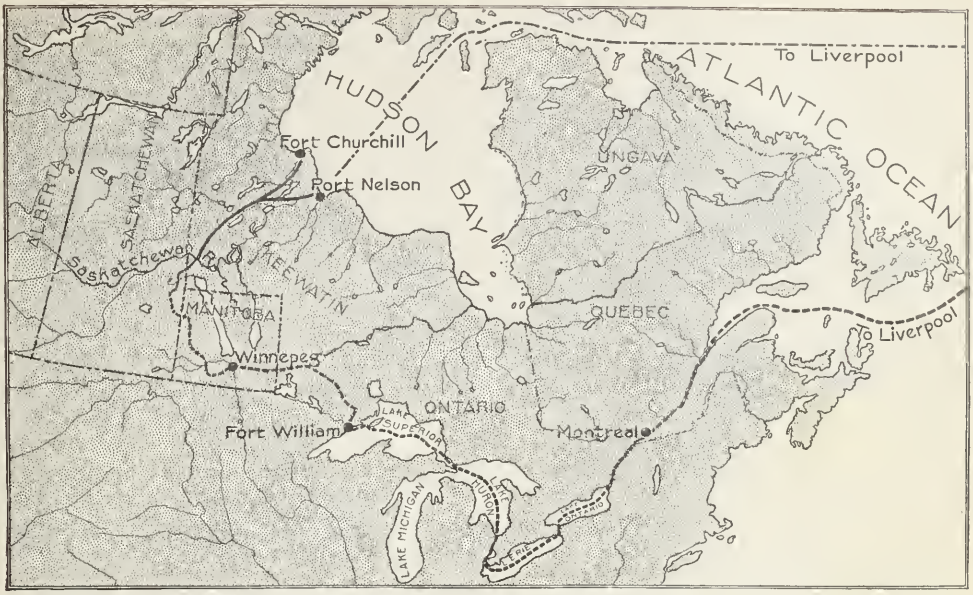
A QUEER PET

Visitors to Southern Arizona find the privacy of their homes invaded in a delightfully free and easy way by the original settlers of that region, namely the scorpions, centipedes, tarantulas, etc., but about the oddest of these house pets is one that visited the writer and remained a constant guest on the screen door and the walls of his tent. It is a little grey lizard about 8 in. long, which differed from the others of his tribe in having two tails, one of them jutting off at right angles from the regulation caudal appendage.

Although he was constantly about the house, it was difficult to get the camera near enough to photograph him, but finally it was accomplished when he was on the screen door and the photographer inside the tent. The photograph therefore shows Mr. Liz-

A Companionable Lizard

ard against the light, forming a silhouette which shows the peculiar forked tail very clearly.—Contributed by C. L. Edholm, Los Angeles, Cal.



Map Showing Proposed Routes of Hudson's Bay Railroad—Note Distance to Atlantic Ocean by Hudson's Bay Route and Via Great Lakes and St. Lawrence River

Why Canada is Building a Railroad to Hudson's Bay

By J. L. PAYNE

Comptroller of Railway Statistics, Department of Railways and Canals, Ottawa, Can.

THE Canadian people, with a growing appreciation of their heritage in the northland of America, and nudged by necessity, are disposed to make large sacrifices for the building of railways. When they of the larger faith projected the Canadian Pacific in 1880, there were many who knew not which to condemn the more—the folly of the government which offered a subvention of $25,000,000 in cash and 25,000,000 acres of land, or the imprudence of the men who proposed to build and operate the road. The Canadian Pacific is today one of the most successful lines of railway in the world. Hence, when other propositions are brought forward looking to the opening up of new territory, criticism loses its edge. The optimist points on one hand to the ever-swelling tide of immigration, more than half of it made up of sturdy and acclimated Americans, and on the other to the experience of the Canadian Pacific.

Adequate transportation facilities constitute Canada's chief need at this moment. The country is developing faster than railways can be built. In addition to the Canadian Pacific, which is the only line on this continent stretching from the Atlantic to the Pacific, the Grand Trunk Pacific is being constructed as a parallel, and the Canadian Northern will soon form another. The federal and provincial governments have extended a generously paternal hand to these latter, as they have to all lines, until today the account of aid in one form and another runs well up to the $700,000,000 mark. No other country in the world has done so much to provide railways, nor done it with such hearty cheerfulness. No other country seems prepared to do what Canada still has in view for

the solving of transportation problems. The idea of building a railway from some point in western Canada to Hudson's Bay is not a new one. Geographical considerations have long suggested it. Such a project was first mooted in the early eighties, and had for its principal advocate Mr. Hugh Sutherland, of Winnipeg. Mr. Sutherland was then a member of Parliament, sanguine and persistent, and he gave up practically ten years of his life to the promotion of this scheme. He first secured from the legislature of Manitoba a bonus of $1,000,000, to which was attached the condition that the road should be completed within five years. That was in 1885. Capital was shy, however, and in the following year the offer of assistance was changed to a guarantee of four per cent on $4,500,000 for a term of 25 years. Even this was insufficient to attract money to the enterprise. Later, the Dominion government held out a subvention of 12,800 acres of land and $6,400 in cash per mile; but no one came forward to claim it, and despite much effort on the part of able men like Mr. Sutherland, more than 20 years elapsed without positive results.

Finally, however, the rapid filling up of the Northwest, and the congested state of the grain traffic during the years between 1904 and 1908, led to an insistent demand on the government to take up the construction of the Hudson's Bay Railway as a public work. The government, already heavily involved in the building of the Grand Trunk Pacific, nevertheless promptly shouldered this new burden, and now stands committed to the policy of providing a railway to Hudson's Bay with all possible expedition.

There are no serious or insurmountable physical obstacles in the way of building the road. Two routes have been surveyed by government engineers; one to Fort Churchill and the other to Fort Nelson. The latter will probably be adopted, because, among other reasons, it leads to the better harbor. The line will start from a point on the Canadian Northern Railway, called The Pas, and run northeasterly to Hudson's Bay. To Fort Churchill the distance would be 477 miles, and to Fort Nelson, 410. When built, it will be a unique railway, in that it will not be operated for more than four months in the year. This element of novelty is quite unavoidable, since it is definitely known that the navigation of Hudson's Straits is rendered inpracticable by ice during, at least the eight months between November 1st and July 1st. At large cost, and as the result of prolonged observations, that much has been ascertained.

The peculiar conditions under which the new railway must be operated, were not overlooked when the government took up the matter. The call of the wheat fields was, however, imperative. A glance at the map will show that for northern Manitoba, the whole of Saskatchewan and part of Alberta, a short and natural highway to Liverpool is afforded by Hudson's Bay. By that avenue the chief market of Europe is nearer by several hundred railway miles than by way of the great lakes and the St. Lawrence. Distance is not always a governing factor in the regulation of rates, particularly by water; but it would seem that the proposed new route would at least effect a considerable saving on grain for export from the territory which the railway is intended to serve. A single trans-shipment, instead of two, figures in this estimate.

To understand the purpose of the Hudson's Bay Railway, it is necessary to know the existing situation with regard to transportation in western Canada. Saskatchewan is essentially a wheat-producing province. The southern and western portions are fertile, but the northwestern area is not so well adapted for farming. It contains many lakes and muskegs or bogs. Into the arable districts a rising volume of immigration is flowing. This means an increasing wheat area. In 1908 the acreage was 2,396,000; this year it is 4,848,000. Every cent per bushel which the settlers may gain in their selling price is important when

S. S. "Diana," Which is Making Surveys at Proposed Terminals in Hudson's Bay—Photograph Taken on June 24 of This Year.

multiplied by millions. At present more than 80 per cent of all grain sent abroad is brought down by the railways to Fort William, whence it is carried by vessels to tide-water. Winnipeg is the center at which the wheat is assembled in car-loads, and the distance from that point to Fort William is 426 miles. It costs ten cents per hundredweight to transport the grain to the head of navigation. The water journey from Fort William to Montreal is 1,224 miles, for which a rate of about 9 cents prevails. Through all the intervening canals vessels pass free of tolls. From Montreal to Liverpool, a distance of 2,760 miles, the charge is slightly over 6 cents. That is to say, wheat is delivered in Liverpool from Winnipeg at a cost of about 25 cents per hundredweight.

Husband and Wife—Types of Eskimos at Fort Churchill—Man in Winter Dress

From Winnipeg to Fort Nelson, a haul of 900 miles,

the freight charge would likely be not less than 18 cents, having regard to the cost of railway operation under such exceptional conditions. To add 7 cents for the 3,300 miles of water carriage from Fort Nelson to Liverpool would probably be within the mark. It may be assumed, therefore, that so far as the great market center of Winnipeg is concerned, the Hudson's Bay route will not bring about any considerable diversion of traffic.

The situation changes materially, however, as one proceeds northward. For all points beyond the center of Manitoba it is obvious that the new railway will have a distinct advantage. Without going into geographical details, it may be said that an immense district lying in the Provinces of Alberta, Saskatchewan and Manitoba, representing a wheat-growing area equal to the States of Dakota, Minnesota, Wisconsin, Nebraska and Iowa, will naturally become tributary to Fort Nelson on Hudson's Bay. From that very large section of western Canada it is estimated that wheat may be transported to Liverpool at from two to six cents less per hundred pounds than by way of the St. Lawrence. If experience sustains this expectation, it may be taken for granted that the Hudson's Bay Railway will serve the precise end which the Dominion government has in view.

It is interesting, however, to observe the physical bases of this expectation. It has already been pointed out that the railway can be operated for not more than four months in the year. The grades being not more than 21 ft. to the mile, it is assumed that pay loads of at least 4,000 tons may be hauled. This implies locomotives of the Mallet articulated compound type, large cars, heavy rails and general equipment to match. Sixteen trains per day for 30 days, making allowance for delays and accidents, would represent the delivery of 64,000,000 bushels of wheat at Fort Nelson per month. The total volume which could be carried over a single track system would probably not exceed 200,000,000 bushels each season; but that is actually a large amount, and, at a saving of three cents per bushel, would mean $6,000,000 a year to the husbandmen in whose interest the road will be built. That sum would be equal to about 25 per cent on the whole capital outlay; so that, from the purely monetary aspect, the government quite properly hopes to make the enterprise pay in the way intended. To put it in another form, the Hudson's Bay Railway will place the farmers of the district alluded to in the preceding paragraph on as favorable a market basis as that occupied by the producers of wheat south of the 52nd parallel.

There is not much probability of settlement along the new route. The surveyors found timber, and it may be that valuable wooded areas will be discovered by prospectors on the uplands away from the main course. The country is not, speaking broadly, suitable for agriculture. Several expeditions sent into Hudson's Bay by the Dominion government have definitely ascertained the existence of rich fisheries, and this fact suggests the hope of some traffic inward. There is also the expectation that cattle may be shipped out by the proposed line, and coal from Nova Scotia and general merchandize from Great Britian for the fast developing west be brought in; but the sole purpose immediately aimed at is to carry out wheat. Local business is not looked for, and it does not seem likely that a passenger car will ever run over the rails.

Here, then, is a railway in process of construction which will, in several important features, make it unlike any other road in the world. It will be first class in every respect, and will cost $25,000,000. It will carry freight only, and, to a large extent, in one direction. It will be entirely idle for at least eight months in the year. It will be built specifically to transport wheat, and the object of the Canadian Government will be fully served if it saves three cents per bushel to the producers of the West. It may save more for the farmers of a certain section; but that figure represents a fair average of the possibili-

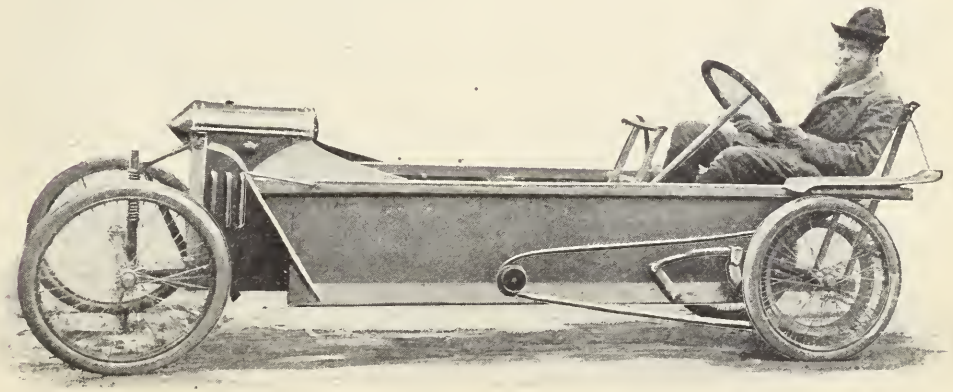
ties according to the estimate of experts. The rates will probably be based on the bare cost of maintenance.

Such an enterprise fairly indicates the disposition of the Canadian people with respect to their basic industry—agriculture. The Dominion has already laid out $100,000,000 on its inland waterways for a corresponding purpose, and contributes more than a million a year toward their maintenance. In this way, the disability caused by distance is in a measure overcome. Abounding prosperity and a steadily enlarging public revenue make such projects practicable without creating an unbearable burden. As the possessors of the last great West, and filled with faith in its potentialities, the citizens of Canada are seeking to provide the facilities for a commerce which has expanded marvelously during the past decade. This year it may mount up close to the billion mark. Measured by population, no other country under the sun is in a similar position. By the same standard, Canada has the highest railway mileage. Territorially it has the lowest.

In providing an outlet through Hudson's Straits, the Government of Canada is merely making use of an avenue which is associated with the cradle days of American commerce. It was on the shores of Hudson's Bay that the company bearing that name set up its primary posts 240 years ago. While Quebec was being fortified and New Amsterdam was but a hamlet, the pioneers of the fur trade were laying the foundations of their empire at the very point where it is now proposed to locate the eastern terminus of a great railway. It was not until two hundred years later that a botanist, who still survives, declared that wheat could be grown in Prince Rupert's Land, at that time the domain of the Hudson's Bay Company.

AUTOMOBILE TO SUIT NEEDS OF INVALIDS

M. Bordelai, the French engineer, has designed a special motor car for invalids and convalescents. The necessity of daily drives in the fresh air for his grand niece, to hasten her recovery from a severe illness, was the incentive to the invention. The machine looks somewhat like a bathtub on wheels and has a long, low wheel base, with deep tonneau to prevent upsetting. The seat, at the extreme end of the car, has a very comfortable back, and the steering wheel is provided with a long shaft which the operator can handle without changing his comfortable position or tiring himself.



Comfortable Motor Car for Invalids

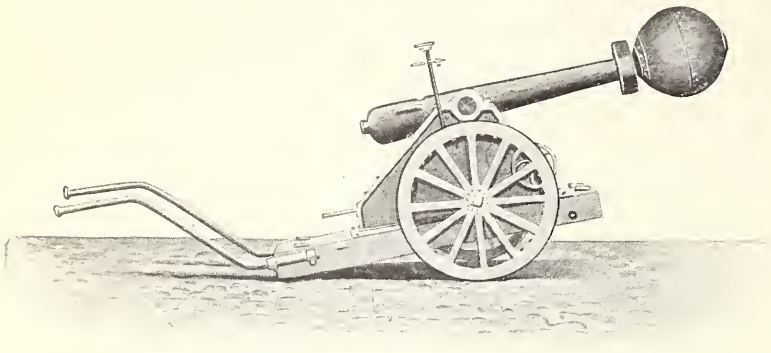
ELECTRIC IRONS USED FOR REPAIRING FURNITURE

It may be possible for the housekeeper of the future to iron out the scratches and dents in her furniture as she does the creases and wrinkles in her clothing. By the use of an electric iron and a specially prepared paste, a firm of New York furniture manufacturers are now able to do all manner of minor repairing of this character, economizing thereby in both labor and material. The process simply requires the filling of the crack or nick with paste, after which an ordinary electric flatiron is passed over the spot thus treated. This causes the wood to swell, and the rubbing or smoothing with the iron restores the original surface. The result is that the damaged piece of furniture regains its original finish.

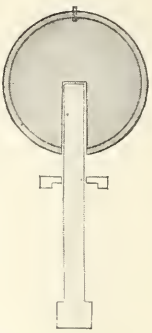
Ironing Cracks from a Damaged Armchair

NEW GUN TO FIRE POISONOUS-GAS BOMBS

Stinkpots and Greek fire, as means of defense and attack in more or less ancient wars, were long ago discarded on the presumption that they were antiquated and useless, yet a great European power is now experimenting with just such projectiles.



Modern Projector of Stinkpots



Method of Mounting Bomb for Discharge

A bomb that discharges flaming liquid over the surface of the water has already been described in these pages, and the device now illustrated is a modern stinkpot, made by the Krupps. It is a shell containing 160 lb. of powder, which, on exploding, fills the air with death-dealing gases. The gun from which the bomb is fired is of the ordinary small bore.

The shell is loosely mounted on a rod, as shown by the drawing. The rod is provided with an enlargement at its inner end which fits snugly into the bore of the gun, while the ring on the rod just below the bomb fits over the muzzle. The propelling charge is placed in the gun in the usual way, then the rod is inserted into the muzzle. When the gun is fired, the rod is projected from the muzzle, but when the enlarged lower end strikes the ring at the muzzle a shock results, which lessens the velocity of the rod, while the bomb continues on its journey separated from it. At an elevation of 45 deg., the bomb travels about 1,500 ft. with destructive effect, while the rod and ring fall at a short distance.

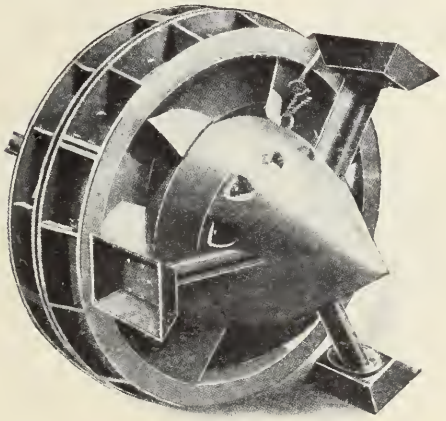
The short range of the bombs limits their use, of course, to engagements at close range, but it is believed they will be very effective in repelling attacks on such defenses as field trenches and breastworks.

CHINESE VERMILION MAKERS HOLD SECRET OF AGES

The manufacture of vermilion, which is one of the foremost industries of Hongkong and entirely in the hands of the Chinese, is very ancient. They made artificial cinnabar long before Europe was a civilized country, and some of the granite stones between which the pulverized ore is ground are almost prehistoric. Even in the present day there are trade secrets in the industry which no European has been able to fathom. There are over one hundred of these plants in Hongkong and Kowloon.

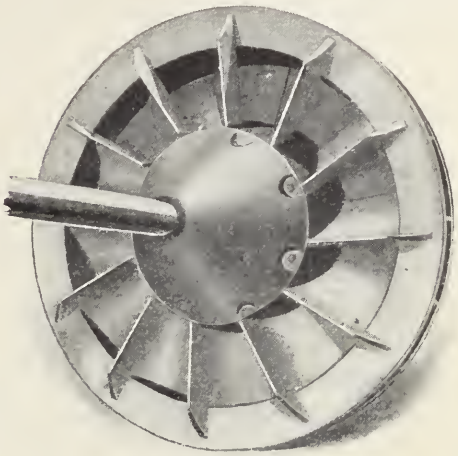
POWERFUL PUMPS FOR DRAINAGE SYSTEM

The completion of the North Shore pumping station for the Drainage Canal at Chicago involves the installation of four horizontal screw pumps, the largest of their kind in the world.



Suction Side of One of New Chicago Screw Pumps —Capacity 250 Cu. Ft. Per Second

The North Shore station, located near the suburb of Wilmette, is designed to pump water from Lake Michigan, and to pump the sewage of the northern sections of the city to the drainage



Discharge Side from Which Water Will be Forced into Drainage Canal—Pump is 9 Ft. in Diameter

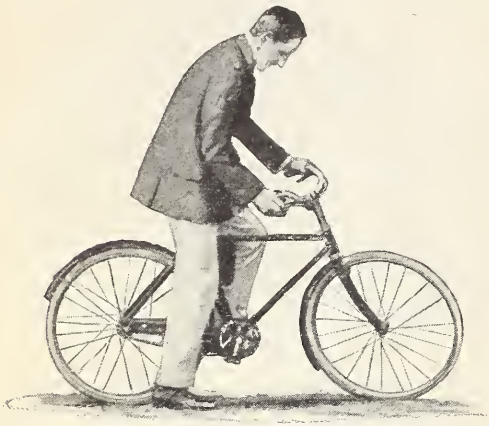
canal and thence to the Desplaines river. There will be four pumps in the new station, each of which will have a capacity of 15,000 cu. ft. per minute against a head of 3 ft. when running 75 revolutions per minute. Each pump will be driven by a 150-hp. three-phase, 60-cycle, 2,300-volt induction motor. The shafts will extend horizontally into the motor room. The station will be about 400 ft. from the lake.

DESTROYER "PAULDING" HAS SPEED OF TRAIN

The new oil-burning destroyer "Paulding," which has just been turned over to the Navy Department, is the fastest boat in the American navy, having attained a speed of 32.8 knots on her trials in September. The "Paulding" attained a speed of 33 knots during one 15-minute period of her trials. Her sister ship, the "Drayton," is now ready for speed trials and it is expected by the contractors that she will be as fast as the "Paulding." The "Flusser" and the "Reid," the two new coal-burning destroyers, were the speediest vessels in the navy prior to the tests of the "Paulding." They were accredited with 30.46 and 31.86 knots respectively.

KING OF SPAIN INSTRUCTOR IN CYCLING

King Alfonso XIII of Spain, in addition to being a thoroughly modern



King Alfonso and His Bicycle

young man, is taking upon himself a part of the training of his infant son, the crown prince. He intends that the boy shall have all the out-door life possible, to guard against the weaknesses that constantly threaten his father. With this idea in view, he is familiarizing the young prince with all sorts of sports. Bicycling is one of the things the king believes the boy should learn and, being himself an expert, has undertaken to show his son just how he should ride.

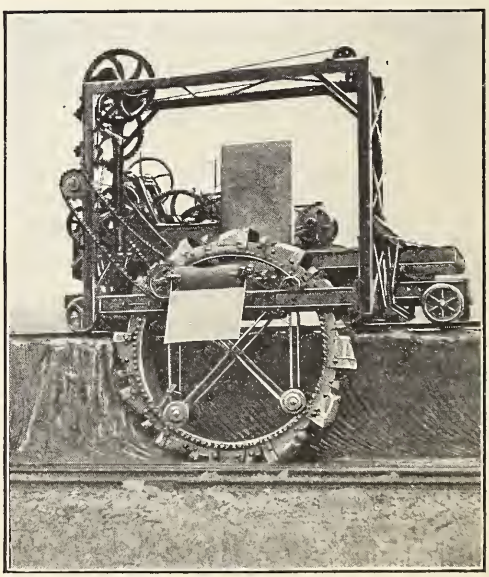
A picture of Alfonso astride a wheel, recently made in the palace gardens at San Sebastian, is considered unique in the portraiture of royalty.

REFRIGERATED AIR FOR BLAST FURNACES

Refrigeration as a means of increasing the output of blast furnaces and reducing the fuel consumption is being used with remarkable efficiency in several plants. In one instance, the use of a refrigerating machine in drying the air for the blast raised the output of the furnace from 350 tons of iron per day to 450 tons. At the same time, the consumption of coke was reduced about 300 lb. per ton of output, the air required for the blast lessened in the ratio of from 40 to 34, and the indicated horsepower of the blower lowered from 2,700 to 2,000. The saving of horsepower alone was sufficient to run the refrigerating machine, which produces 250 tons of refrigeration per day; and the additional savings were large enough, it is said, to leave even a margin of profit on the first cost and maintenance.

CLAY DIGGING MACHINE

A clay digger used successfully in fairly level clay fields is here shown. The excavating wheel has no axle, but revolves upon anti-friction wheels placed just outside its rim. As the excavating wheel revolves, each bucket cuts off a slice of earth, and dumps it onto a belt conveyor near the top. The illustration shows the excavator as used where the clay is worked in terraces 5 ft. high. The cars, into which the clay falls from the digger, run on a track on the terrace below the digger.



Digging Clay in Terraces

When the clay pit is not deep and the clay is solid and hard, the machine is run on wheels as a traction engine.

First Plowing on Reclaimed Land Three Months After Water Was Pumped Off. Land Was Covered With 10 to 30 Inches of Decayed Vegetation

Reclaiming the Vast Marsh Lands of the Delta Region

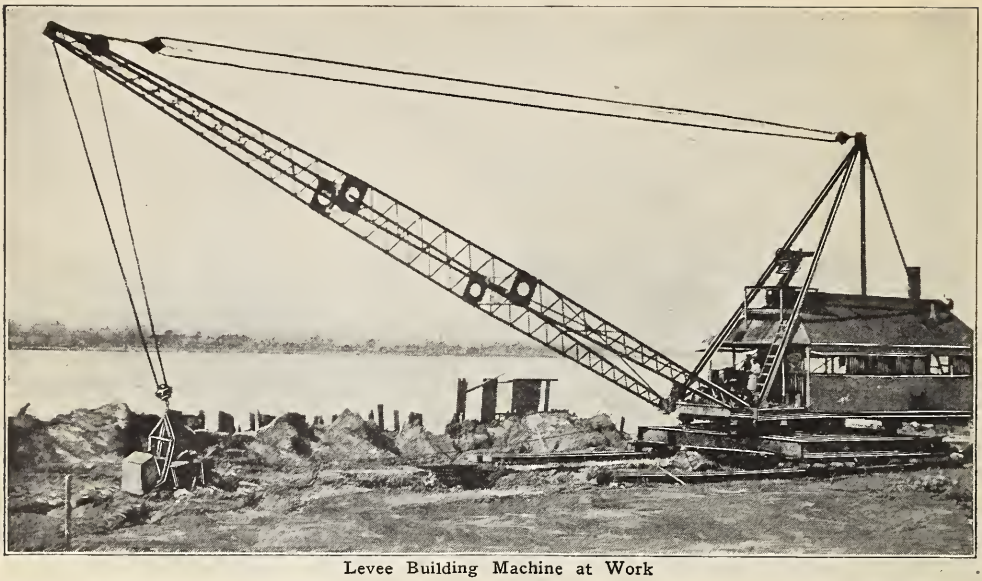
By LOUIS A. DODGE

WHILE the eyes of the speculative and commercial world have for years been turned toward the vast projects of reclamation of arid lands in the far West, attention is now being directed to projects in the lower Mississippi Delta where millions of acres of land are being reclaimed.

There is a vast difference, however, in the means and manner of reclamation. In the West, the plan is to get the water on the lands; in the South, it is to get the water off the lands. Were it a question of irrigating the lands being reclaimed in the lower portion of Louisiana and Mississippi, the proposition would be simple. It would only be necessary to tap the vast Mississippi River and an abundant supply of water would be obtained at very little cost. But the work to be accomplished in southern Louisiana and Mississippi is to get rid of the surplus water and drain the lands.

It is the dream of those interested in the project to make the territory adjacent to New Orleans the corn belt of the United States. This may startle the farmers in Kansas, Illinois, Nebraska, Iowa and other states, but figures show that Louisiana, at least, is growing fast as a corn-producing state. In 1908, it produced 31,198,000 bushels and in 1909, 51,198,000 bushels, an increase of 60 per cent—a greater percentage increase than any state in the Union. The crop for this year is expected to be 75,000,000 bushels. Not only will corn be the product of reclaimed lands, but almost every known product except possibly apples and wheat can be grown.

Not only will the farmers of the middle and western states realize soon that swamp reclamation is bringing forth a strong competitor, but when the facts are known, they will look upon the Mississippi river and its northern conflu-



Levee Building Machine at Work

ents as great thieves, for the rich soil that covers the sub-soil in the wet lands of Louisiana and Mississippi was stolen from the hills and plains of the states through which the rivers flow and deposited in the lower delta to mingle with the decayed vegetable matter of ages and create as rich a soil as exists in the world.

Take a map of Louisiana and draw a line across the state through Lake Pontchartrain, Donaldsonville and Lake Charles and below this, more than 11,000 square miles, is an area of land much of which for years was looked upon as worthless and classified as swamp land. Yet part of this land in the vicinity of Houma and Thibodeaux has a natural drainage, and the remainder, the greater portion by far, although lying below tide level, can, at a cost of about $20 per acre, be drained

A View of a Levee Along the Mississippi

and made into highly productive fields. Fringing this land is a length of sea coast lapped by waters that produce some of the finest fish and oysters of the world. Running through the area is the Intercoastal Canal under construction by the government. Within the tract is produced the great rice crop of Louisiana, almost two-thirds of the sugar, 60 per cent of the cypress and about 70 per cent of the commercial truck farm products of the state. Within its borders are located great salt and sulphur mines.

There has been some criticism that the government should spend millions to reclaim arid lands in the west, far from the centers of population, while nothing has been spent to reclaim wet lands, of many times the productive capacity, adjacent to the points where millions of citizens have resided for centuries.

Reclamation will, it is believed, also change the social and political condition of the South. Where in the past vast areas have been owned by the sugar and cotton kings, the small and independent farmer with his few scores of acres will step in and be the controlling factor of society.

The processes of reclamation in op-

Sod Corn, 71 Days After Planting on Reclaimed Land at Raceland, La.

Drainage Canal on Reclaimed Lands of Louisiana. Canals Furnish Water and Transportation Through the Southern Part of the State to New Orleans Market and to Gulf—This is the Holland of America

eration are most interesting. First the vast tracts are divided into districts of from 1,000 to 5,000 acres. Then around each district a main canal is dug 8 ft. deep and 40 ft. wide. The earth from the canals is piled into an embankment or levee surrounding the district. As the rain fall in Louisiana amounts to about 60 in. per annum, the problem is only to get rid of the surplus. The maximum variation of the water level is about 3 ft. and the embankments are usually built to a height of 5 ft. It has been found that canals of the dimensions mentioned, with their lateral ditches, are sufficient to take care of a rainfall of 2 in. in 24 hours.

Pumps operated by steam or gasoline remove the water from inside the levees and into the canals or nearest waterways. Lateral ditches are dug at intervals of 1,300 ft., and are 8 ft. wide and, sometimes, when necessary, there are sub-lateral ditches dug 300 ft. apart.

Notwithstanding the heavy rainfall, it has been found by experience that it is only necessary to operate the pumps about 30 days of a year, the lift being from 3 to 6 ft. Sometimes instead of a pump, a wheel operating in a sluice, like an undershot wheel, but traveling in an opposite direction, is employed. This wheel pushes the water over the levee, through the sluice, and drains the area. The average cost for a pumping plant and the digging of ditches has been estimated to be about $20 per acre.

It might be said that every acre of land in southern Louisiana, including the City of New Orleans, is reclaimed land. For the construction of the vast system of levees along the Mississippi was really the beginning, and the numerous levees surrounding the reclaimed areas of swamp lands are practically a continuation of the system. For years, New Orleans was referred to in state correspondence between England, France and Spain as the "Island of New Orleans."

So far the swamp land reclamation is in its infancy, as the area to be reclaimed is much greater than that reclaimed. The projectors are getting an average price of about $65 per acre for the reclaimed land—land that some 50 years ago was deemed practically worthless and was frequently sold at a price of 25 cents or less per acre.

AN AERIAL FLEET FOR THE ARMY

By L. WILLIAM THAVIS

Congress will be asked during its next session to authorize the formation of a battalion to be known as the Areo-Wireless Battalion, which is to be a part of the U. S. signal corps. This organization will be composed of four companies of 150 men. The men will be trained in taking observations from balloons and aeroplanes, and also in dropping of explosives, while the air ships will be equipped with wireless apparatus in order that there may be constant communication between the occupants and the coast forts. It is understood that the corps will be started with at least three dirigible balloons and 15 or 20 aeroplanes. This, it is claimed, will necessitate an outlay of about $600,000.

The officials of the War and Navy Departments feel that recent developments in aviation have proved to Congress the necessity of keeping abreast of the other nations. It has been calculated by some of the experts in the Navy Department that the aeroplane is seven-tenths less dangerous to the crew than is the submarine.

There have been advanced by officials of both departments the following reasons why the aeroplane may be preferred to the submarine as the means of attacking battleships, and may be used to attack fortifications on land:

1. That ordinarily not more than two deaths can occur at the time an aeroplane is disabled and crashes down.

2. That this number cannot exceed five; that it is recommended that military or naval aeroplanes for purposes of offense be limited to a crew of three men, including the driver.

3. That a parachute, as a complement of safety, offers no little advantage to the aeronaut who must resort to it, and that its use ever since aerial travel has been attempted has proved its value.

4. That the aeroplane offers a slight body for attack; that unless it hangs low, it is unlikely that damage sufficient to drop it can be inflicted upon it with a projectile.

5. That invulnerability of the driver or crew can be encompassed by means of a protective steel plate beneath the men, and that its weight, based upon its length and width, need not be great. It is estimated that an oblong steel plate, 3-10 in. thick, 5 by 7 ft., will deflect a well-directed shot.

6. That smaller and lighter plates can be attached to an aeroplane, manned by a driver who is a skilled artilleryman, in case of rapid and hasty destructive action against the enemy's ship or fort.

7. That those in an aeroplane are better informed than those in a submarine, because they can hear and see, and are less likely to run against an obstacle at the risk of their lives.

IMPROVED BRITISH MINE RESCUE APPARATUS

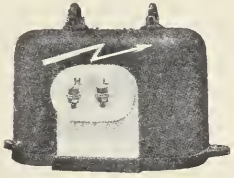
Experiments at the Lancashire and Cheshire Miner's Rescue Station, Atherton, the first station of its kind in Great Britain, have developed a rescue apparatus with which it is said that the men so equipped can work for five or six hours in the most deadly gases, without the slightest inconvenience or exhaustion.

The weight of the apparatus is 28 lb., but nearly all this weight is borne by a belt around the waist. The feature of the device is the absence of a helmet. A headpiece, provided with straps, holds the mouthpiece in position over the chin and lips, and a light clamp fits over the nose, closing the nostrils. The supply of air is drawn from the breathing bag, which hangs down from the shoulders in front, through pipes leading to the mouthpiece. The exhaled breath is carried by another pipe to a receptacle filled with caustic soda, by which the poisonous gases are absorbed. Goggles are worn to protect the eyes.

Front and Back Views of New Rescue Apparatus

DANGER SIGN FOR HIGH VOLTAGE APPARATUS

Although practically all modern electric apparatus are safe in design, it is wise to use extra precautions when in the vicinity of high voltages, and to this end a zigzag arrow has been adopted in Germany as a warning. The arrow head signifies danger, and the zigzag lightning flash is emblematic of high voltage. The danger sign is placed conspicuously on the casing of all high-voltage devices.

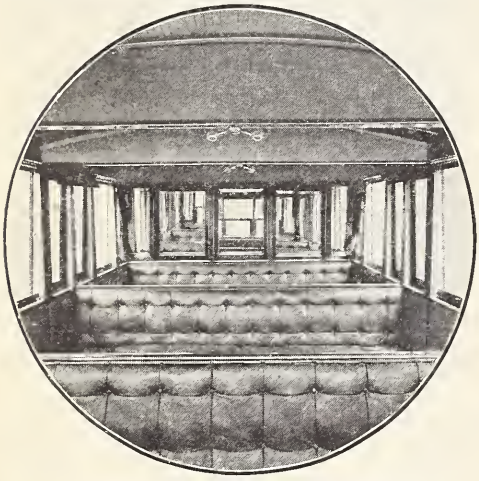


¶A French inventor claims to have discovered a process of making automobile tires of paper.

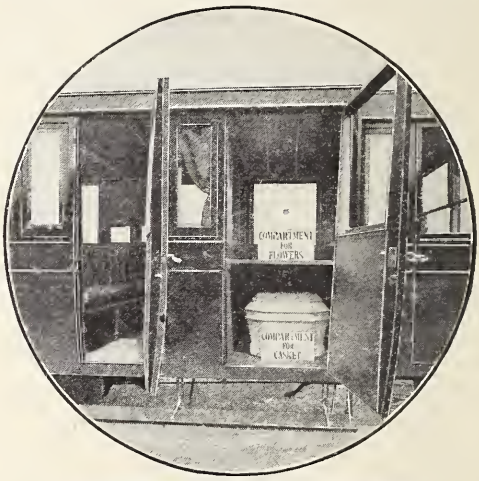
AUTOMOBILE FUNERAL COACH AND CHAPEL COMBINED

An automobile funeral car with a compartment that will seat 36 people, in addition to space for the casket and flowers, is attracting much attention in Cleveland, Ohio. The car has been used for a number of funerals and takes the place of nine closed carriages and a hearse. In bad weather it can be used as a chapel at the cemetery.

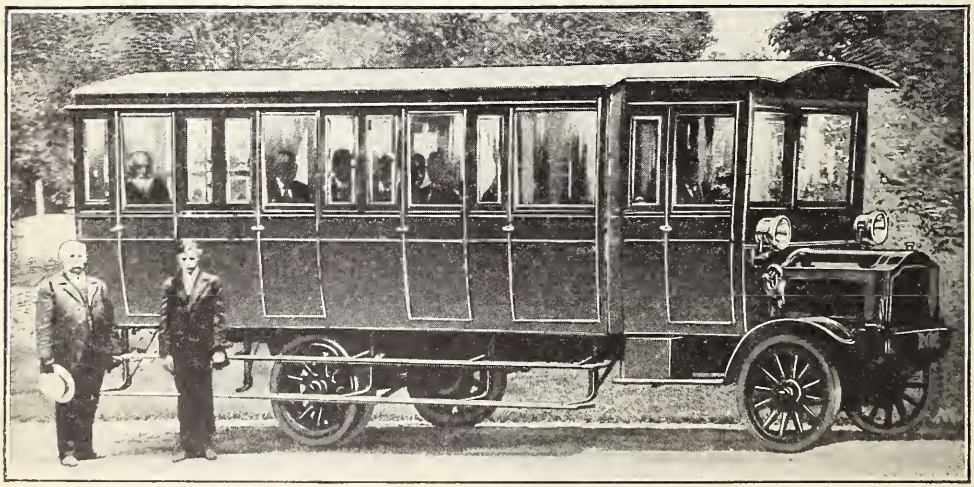
The car is 22 ft. 8 in. long and 7½ ft. wide. The compartment for the casket is 2½ ft. wide, and 2½ ft. high, while that for the flowers is 2½ ft. wide by 5 ft. high. The floor of the car rests on heavy cross sills and there are steel braces from the floor to the roof. The interior is finished in oak and upholstered in leather. Electric lights are used for illumination, the current being obtained from a small storage battery. The driver's compartment has no connection with the remainder of the car.



Interior View of Automobile Funeral Car



Compartment for Casket and Flowers

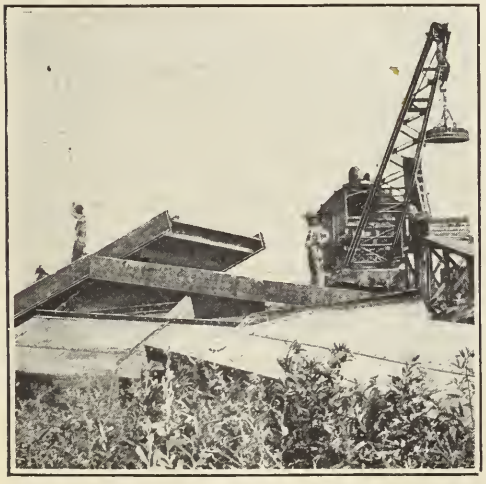


An Automobile Funeral Car Which Carries 36 People and Can Be Transformed into a Chapel at the Grave

But little more power is required to operate the big motor than is necessary for the ordinary automobile. The speed usually attained is eight miles an hour, but the engines are capable of 14 miles an hour. The wheels are fitted with solid rubber tires, and precaution has been taken to eliminate everything that will cause delay or embarrassing breakdowns. This is the only car of its kind in the world, it is claimed, and its designer is at work on plans for other cars to be used for larger funerals, either singly or in conjunction with one or more of the type now in use.

THE LAST CHAPTER OF THE FRENCH CANAL PROJECT

Using it as ballast, the government is bringing to the United States the junk left in the Panama canal zone by the French company when the canal project was abandoned. When it arrives in this country, the junk is sold by the shipload to the highest bidder. A Harrisburg steel company recently bought a shipload of the old engines and bridges abandoned by the French in Panama and is cutting it up, to be melted over into marketable steel. The accompanying pictures show some of the little oil-burning engines used by the French in Panama and some of the bridge steel made in France and shipped to Panama, but never erected there.



Portions of a Panama Canal Bridge That Was Never Erected, Now Scrap Iron—Made in France and Shipped to the Isthmus

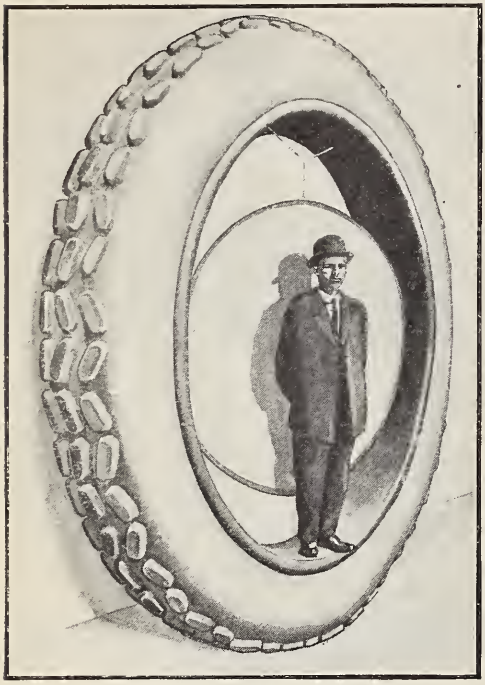
Some of the Little French Oil-Burning Locomotives Intended for Work on the Panama Canal Projected by the French

THE COST TO BELFAST OF TWO GREAT LAUNCHINGS

An interesting side-light on the launching of the two great White Star liners, the "Olympic" and the "Titanic," is the amount of money, $300,000, the Belfast harbor board has had to expend in making the harbor facilities meet the requirements. When the shipbuilding company gave the ordinary notice to the board's engineering staff for the dredging of the basin to a sufficient depth for floating the vessels, it was discovered that the zone of the launching approached so closely as to endanger the stability of the Victoria wharf, and, this difficulty disposed of, the vessels were found to be too long to be safely turned around in the harbor. The excavation of an embankment was ordered at an estimated cost of $50,000, but the actual cost reached $150,000. Then $150,000 more had to be expended in deepening the Victoria channel to a depth of 32 ft. below spring tides.

LARGEST AUTO TIRE IN WORLD

This giant automobile tire, said to be the largest in the world, was exhibited in Detroit as an advertising feature by a tire-making concern. According to standard tire sizes, it would be a 96-in. by 12-in. tire. Its size as compared to that of a man is clearly shown.



A Giant Tire

FAN VENTILATION FOR STREET CARS

The problem of the proper ventilation and heating of street cars presents many difficulties, and although the public is continually urging improvement, but little has been accomplished.

The rejuvenated Chicago traction system is attempting to meet the demand by means of motor-driven ventilating fans, which force fresh air up through electric heaters, thus assuring a supply of warm, pure air in all parts of the cars. About 350 cars have been or are now being so equipped.

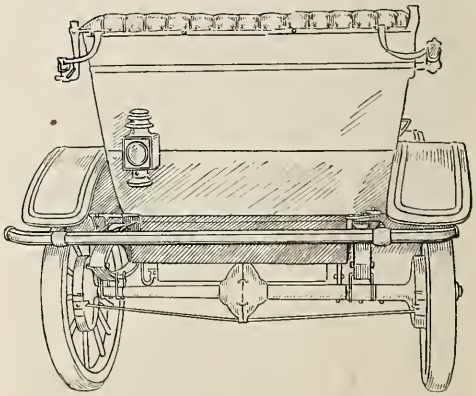
LONG-DISTANCE WIRELESS INSTALLATIONS

Several long-distance wireless stations are being installed in Africa and New Zealand, those at Figuig, Loango, Libreville, Brazzaville, and Abeshr in the Tchad region, Africa, being for military purposes. These stations will be capable of communicating with the Eiffel tower station in Paris. It is also proposed to establish communication between the French West African coast and the South American continent.

The government of New Zealand will erect two high-power and three medium-power stations, the former near Doubtless Bay, in the northern part of the North Island, and at the extreme south of the South Island. These stations are to have a minimum range oversea of 1,250 nautical miles, and will be capable of communicating with each other, and with the station of the Australian Commonwealth near the entrance to Sidney Harbor. From Sidney to Doubtless Bay is about 1,300 miles.

REAR BUMPERS FOR AUTOMOBILES

Bumpers for the rear of automobiles as well as the front are now being advocated. The rear bumper is attached to the spring hangers, and provides adequate protection for the rear axle, gasoline tank, and tail lamp.



Automobile Provided with Rear Bumper

Falls at Intake—All of Plant That Is Visible

Five Thousand Horsepower From Air Bubbles

By FRANK MAYNARD

UP in the Cobalt mining district of Canada, just eight miles south of the new mining town called "Cobalt," at Ragged Chutes the Montreal River, is an extraordinary power plant from which more than 5,000 hp. in compressed air is gained by making, capturing, and confining air bubbles. It is the largest natural air compressor plant in the world, the compression being effected by the direct action of falling water, trapping particles of air in its descent, and afterwards liberating them in a confined chamber under pressure.

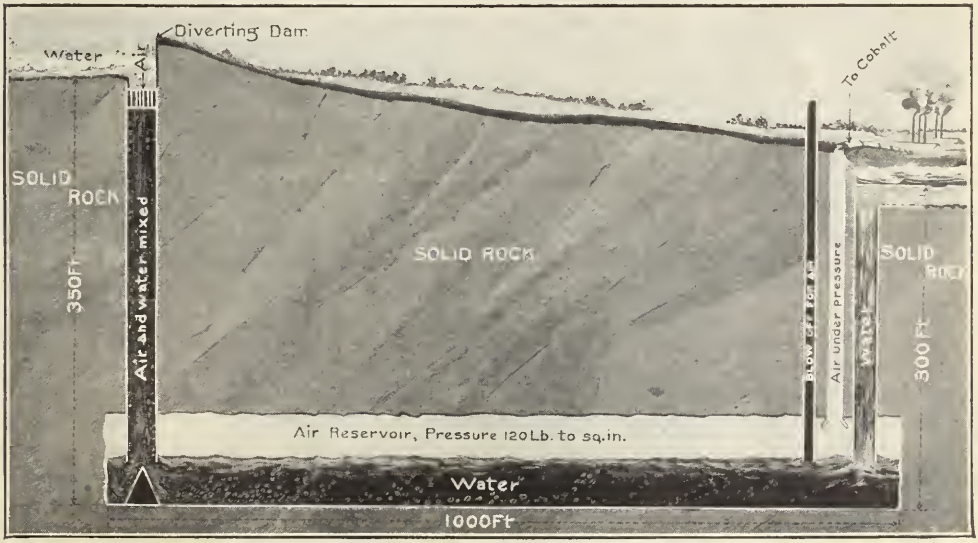
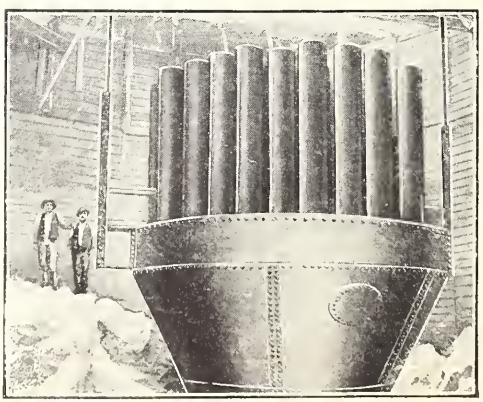


Diagram of the Plant, Showing How Air Escapes from Water into Reservoir and Is Transmitted under Pressure through Pipes

The trapping and confining of the air bubbles are, of course, two important features on which the system hinges, but a third feature, is the means by which the falling water is broken up and impregnated with more air, in finely divided particles, than the natural tumult of the fall would alone provide. This is accomplished by means of curious intake heads, 16 ft. in diameter, each of which is studded with 66 intake tubes or pipes, 14 in. in diameter. The water gulps the air down with it into these pipes, passes into a tunnel, and the air bubbles are forced to the surface.

Geyser Formed by Safety Blow-Off

The nature of the plant and its method of operation is interesting. Stretching across Ragged Chutes is a 660-ft. dam, and there, at the intake gates, are the two 16-ft. intake heads which break up and receive the air-charged water. By means of vertical pneumatic lifts, operated by compressed air piped from the air mains, these heads are maintained at a height which slightly submerges the tops of the nests of 14-in. intake pipes. These pipes, as before stated, gulp both air and water, which, in its descent of 351 ft., becomes a mixture of water and compressed air. The intake heads, being funnel shaped, decrease to a diameter of 9 ft. at the lower ends, and discharge the water and air into pipes of that size. Some 40 ft. from the bottom of the shaft leading into the compression tunnel, however, these pipes increase in diameter to 11½ ft., which tends to lessen the velocity and liberate the air. Two steel-sheathed concrete cones receive the full impact of the water and divert it into the horizontal tunnel, which is 1,021 ft. long, following the flow of the river. This tunnel is 26½ ft. high at the intake end, 42 ft. high near the bottom of the tail-shaft, and 22 ft. wide for its entire length.

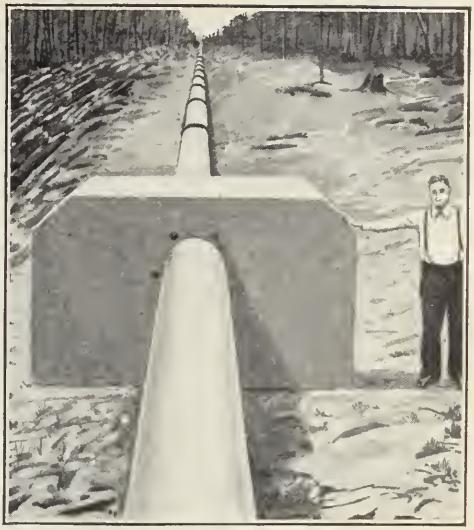


One of the Intake Heads

Diverted into this channel, the water loses momentum, and the air, now under a compression of 125 lb. per cubic foot, is freed. At this pressure it loses all but a negligible amount of its moisture.

Near the bottom of the tail-shaft, a 24-in. pipe enters the funnel from the top, and it is through this pipe that the air is forced to the surface and into the 20-in. main that serves the mines. The water races past, and, as the tunnel is smaller at this point, forms an air-tight seal that leaves the compressed air no

Expansion Safety Joints



Method of Anchoring Pipe Line

other vent. The water itself enters the tail-shaft, and overflows into the river.

The shape of the compressor tunnel and its shafts and air-pipe lines, all embedded in solid rock, 351 ft. below the surface at one point, is shown in the drawing. Just at one side of the pipe by which the compressed air is led to the surface is a blow-off or safety-valve pipe. When the compressed air is in excess of the demand of the mines, a stream of mixed water and air issues from this 12-in. pipe with an action like that of a geyser. This has at times reached a height of over 500 ft. above the level of the river.

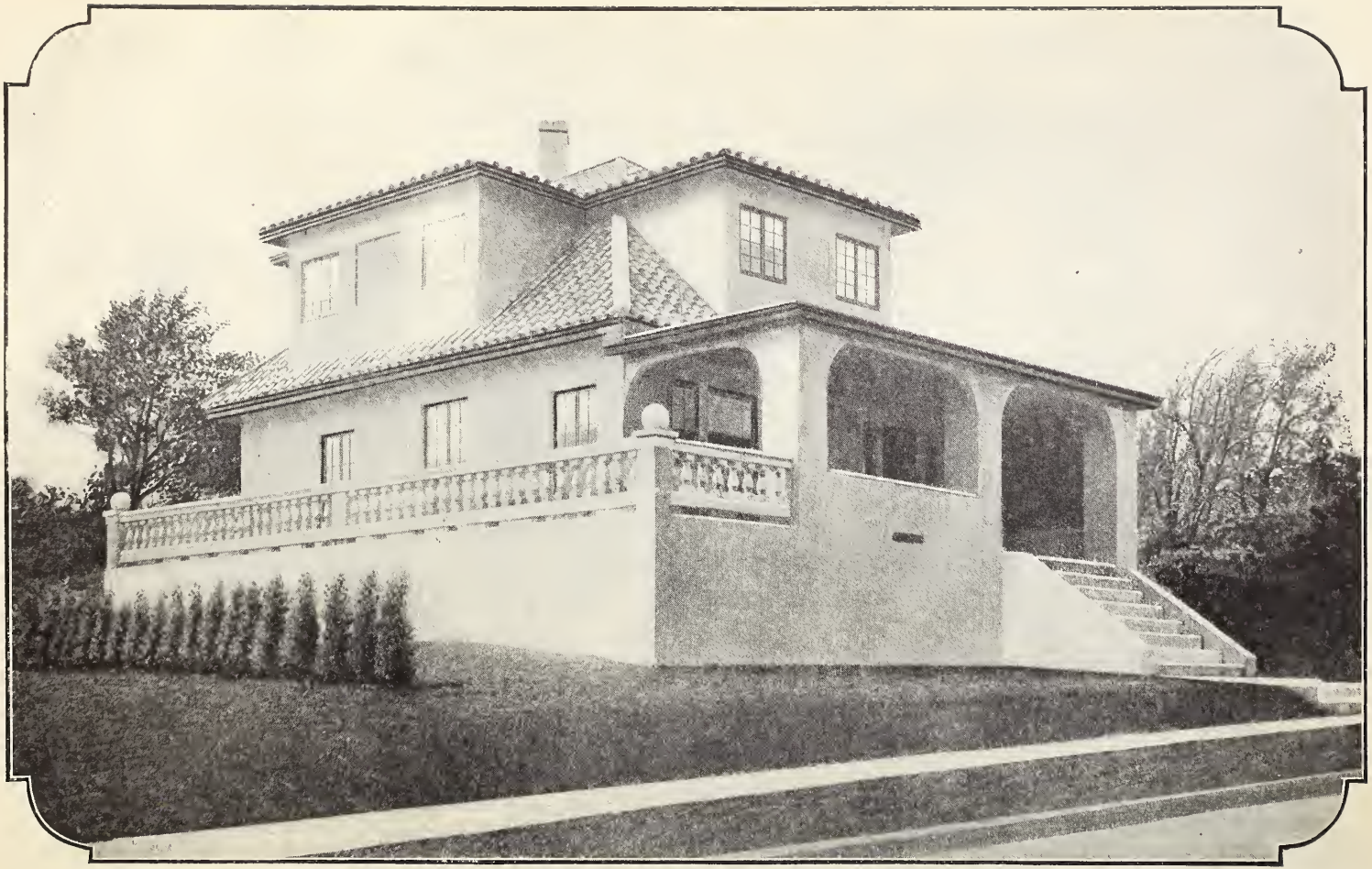
The pipe line carrying the air from this natural compressor to the mining camps is nine miles long and 20 in. in diameter, made up of 40-ft. lengths of seamless flanged steel, each length weighing 3,000 lb. Branching from this main line are two loops of 12-in. pipe aggregating a little more than five miles. To guard against the evil effects of unequal temperatures, the line is anchored to heavy concrete piers on solid rock foundation at half-mile intervals. Half way between each pier expansion pipes are provided.

The compressed air is sold to the mining companies and other concerns at Cobalt in the same manner that gas or electricity are sold in other communities. It is said that it has cut the cost of compressed air in Cobalt in two and made possible the development of dozens of properties.

Why the natural air compressor system was adopted rather than that of developing and transmitting electric current through the camp for the driving of mechanical compressors has to do with economics. One attendant can take care of the entire generating end, and the maintenance cost has hardly to be considered. There are no moving parts other than four hydraulic jacks to raise and lower the heads, and one automatic check valve, consequently there is practically no wear and tear. Also, the air so compressed is much dryer than by other means, curious as it may seem. This is very important, as there must be no possibility of the supply being cut off by reason of the excessive cold weather during the winter months.

The plant is now furnishing approximately 4,000 cu. ft. of air, under a 100-lb. pressure, per minute to the Cobalt camp.

¶Half a million tons of beet sugar was produced in the United States during the past year.



FOUR-THOUSAND DOLLAR CONCRETE HOUSE AT WATERTOWN, MASS.

House contains seven rooms, not including laundry and basement. Cost would have come under $3,000, but for expensive interior decorations.
Owned by William C. Murphy.

The Discovery of Pure Radium by Mme. Curie

By GEORGE E. LIGHT

(*Paris*)

WHEN M. and Mme. Curie startled the world in 1903 by announcing the discovery of radium, it was understood by scientific men to refer only to composed salts of this mysterious metal, such as bromure and chlorure of radium, for "radium" proper, it was contended, could not be isolated. It was known to exist some years previously, but it was due to the researches of M. and Mme. Curie that it was captured in any form whatsoever.

MME. CURIE
The Acknowledged Leader of Her Sex in the World of Science

Professor P. Curie was called to his Creator soon after. But the widow of the illustrious French chemist, who had assisted her husband in his first discovery, continued the work. She was granted by the Academy of Paris and the French Government a professorship at the Sorbonne, where she could pursue her investigation and at the same time receive the financial grant which accompanied the position. By dint of much experimenting, aided by Professor Debierne, she has finally succeeded in obtaining an infinitesimal piece of pure radium in a metallic form, and the world is richer by another great victory over nature.

This strange body, which is now definitely known for the first time (unless the ancients, who were acquainted with many arts subsequently lost to mankind, had captured the metal—which is very doubtful), has a white appearance, but oxidizes very rapidly when brought in contact with the air, and quickly turns black. If it is placed on a piece of iron, it will strongly adhere to the same; it will burn paper when left upon it, and it apparently shows much energy in decomposing water. Its best prison therefore is in a vacuum, and the unique specimen which exists up to the present has been placed in a glass tube, sealed by means of a blow pipe, the air having been previously exhausted. Nothing yet is known of its other prop-

erties, and the next study will be to trace the radio-active power of metallic radium. All that can be said for the moment is that this matter in a pure form now exists.

It was by operating on one grain and a half of salts of radium, which had previously been extracted likewise with great care, that the two scientists arrived at the result which has set the chemists of all countries thinking. This minute body was treated by amalgamation by means of an electrolytic process. The discovery was announced in a very modest manner. Although a few intimate friends were aware of the progress being made, it was only on September 6, 1910, in an official letter to M. Van Tieghem, permanent secretary of the Academy of Science, in Paris, that Madame Curie informed that august body of the great scientific work M. Debierne and herself had just accomplished. Pure radium, in a metallic state, had finally been discovered.

The effect this may have on humanity is tremendous. The salts of radium have already proven a powerful accessory in medical treatment of various diseases. The only drawback to universal use is the rarity of the metal and its cost. The market value of 1 gramme (hardly 15 grains and a half, Troy) is said to be $77,000. Cancer is treated by the means of radium, and there have been many cures. Out of 68 cases of cancer of the skin, 64 cures were effected in one hospital by the use of its rays, in three years. Large vascular tumors have been stopped, "port wine" stains and tenacious scars removed, and numerous birthmarks effaced. It is also being tried in cases of chronic rheumatism, eczema and even tuberculosis. Experiments were made on the blind, but it has not yet been shown that it can be employed in restoring sight.

The effect of the radium rays is only remarked when brought within four inches of the eye. A strange faint, pale green luminosity is then said to be apparent to some people.

As M. Curie pointed out soon after his discovery, this radioactive body possesses three fundamental properties. It emits spontaneously rays which will affect photographic plates in the same manner as light; it gives off electrized objects, and penetrates most substances. A photographic plate, even when wrapped in a piece of black paper or covered with a thin sheet of metal, is at once spoiled when placed near radium. All the magnetic power in a loadstone can be eliminated by placing a glass tube, containing radium, between the poles.

The work of obtaining the salts of radium is long and tedious. Radium is said to exist in all kinds of earth, but that of a calcareous nature is the most rich. Madame Curie has, during the past two years, experienced some difficulty in securing sufficient salts of radium for her work of isolating the pure metal. The factory at Joachimsthal, near Marienbad, Austria, is now the largest producer, the ground surrounding being quite rich in radium-bearing ore, and although this establishment owes its existence to a great extent to the discoveries of M. Curie and M. Becquerel, two Frenchmen, Madame Curie has been hampered in her research by the impossibility of being supplied by Joachimsthal. She was told that permission of the Austrian Government was necessary, and when a high personage in the dual monarchy interested himself in her behalf, the reply was given that she could not get a supply until applications previous to her own had been attended to by the authorities. The result was that Mme. Curie has had to obtain her radium-bearing ore from other sources, which has considerably hampered her in her work.

NEW PHOTOGRAPHIC GAME

The possibilities of amateur photography as a contest game have been demonstrated by the members of a country club at Lake Forest, Ill., which is the summer home of many of Chicago's wealthy people. Instead of wandering singly through the ravines,

Photographic Contest at an Illinois Country Club

woods, and fields of the colony, picture-taking expeditions were organized, certain scenes or objects were selected as suitable for photographing, and every contesting member took a picture of each. After each expedition the results obtained by each member were compared, and a committee decided which pictures were best. The winners received prizes.

THROUGH NIAGARA'S RAPIDS IN A MOTORBOAT

THE turbulent stretch of water below Niagara Falls, consisting of the Whirlpool Rapids, the Whirlpool, and Devil's Hole, was successfully navigated, part with and part without power, by a little 18-ft. motorboat on Sept. 19. The boat, the first of its kind ever to attempt such a passage, and its navigator, Captain Klaus Larsen, of Cleveland, emerged at the end of the journey without suffering serious damage, although to the thousands of watchers disaster seemed inevitable.

The boat was one specially constructed for the trip. But 18 ft. long, she had a beam of 5 ft. 2 in., a draught of 2½ ft., and was completely decked over with the exception of the small circular cockpit in which the navigator stood. Water was kept from entering the boat through this cockpit by means of a circular canvas shield, made fast to the rim of the cockpit and belted around the waist of Captain Larsen. The hull of the boat was provided with several hundred pounds of concrete ballast.

Starting from the Maid of the Mist landing on the Canadian side, Larsen headed for midstream and shot into the swift drift down the big rapids. He held the tiller rod tightly and guided the little boat well as she leaped along through the breakers.

The Whirlpool was the critical point in the hazardous trip. The staunch little craft plunged bravely into the waves and rode them like a cork. Often she appeared to be completely submerged and at other times keeled over to an alarming degree. The wisdom of the navigator in putting in a heavy ballast was demonstrated by the manner in which the craft righted when struck broadside by the waves. At one point she spun around like a top in spite of the efforts of Capt. Larsen to keep her out of the center of the pool, but the tiller was jammed over hard and the course was regained.

Although every precaution had been taken to make the boat watertight, considerable water found its way into the cockpit and under the flywheel of the engine. It was splashed over the unprotected spark plugs and caused a short circuit. This stopped the engine which up to that time had behaved perfectly.

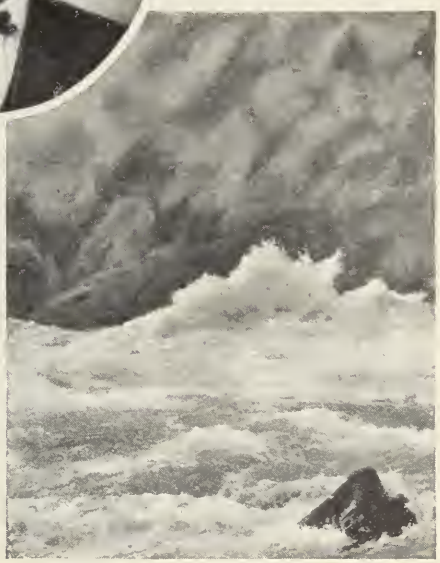
Buffeted about in the rapids, the craft had a hard time of it, being obliged to drift at the will of the waters. The more dangerous spots were avoided with great difficulty, for the craft was swinging around helplessly.

A landing was finally accomplished at a point about a mile above Lewiston.

"The trip was worse than I thought it would be," said Larsen, after he landed, "but I could have finished easily if the plugs had not short-circuited after leaving the Whirlpool. The engine ran perfectly up to this point and I had the boat under perfect control. I was only in danger once, when I drifted broadside into the Devil's Hole; there it seemed as though I turned clear over. I will build another boat with more beam and power and try it again some day."

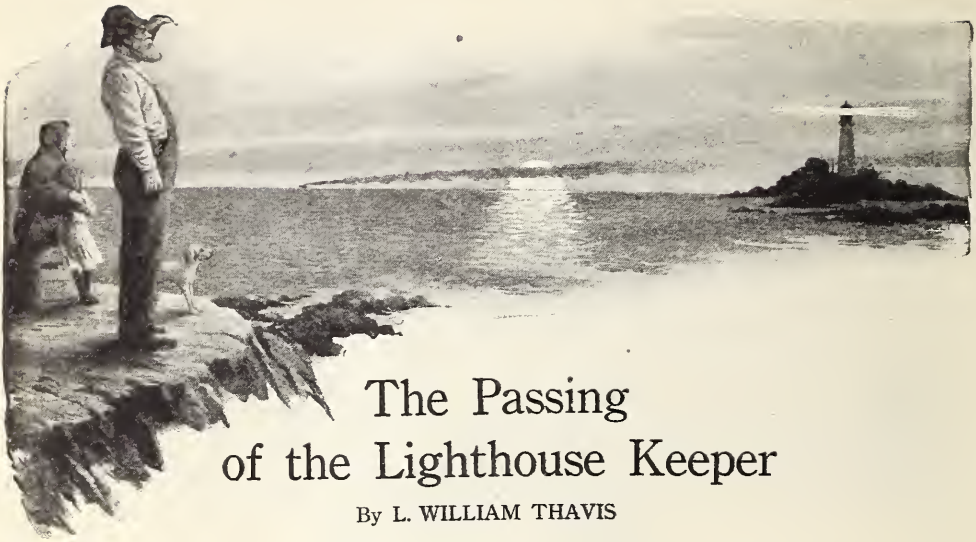
Capt. Klaus Larsen and the Craft which he Navigated through the Niagara Rapids

The Rapids



The Great Wave

¶The "Mauretania" clipped ten minutes from the best previous westward passage of the Atlantic on the trip which ended at New York, September 15, the time for the voyage being four days, 10 hr., 41 min. and the vessel's average speed 26.06 knots. Three days before, the "Kronprinzessin Cecilie" lowered the record from Cherbourg to Sandy Hook, her time being five days, 10 hr. and 23 min., which is 46 min. faster than the previous record.



The Passing of the Lighthouse Keeper

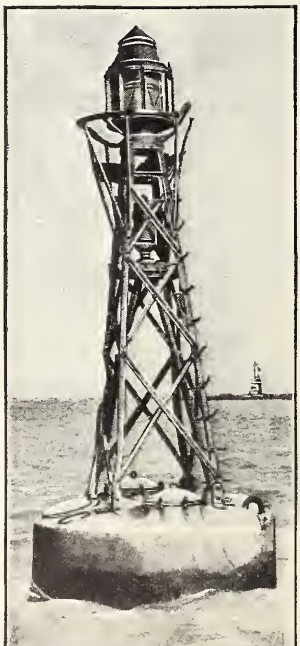
By L. WILLIAM THAVIS

THE adoption by the government of acetone gas, acetylene dissolved in acetone, for use of lighthouses, beacons, lightships and lightbuoys, will soon revolutionize the whole system of coast lighting in this country, and the lighthouse keeper and buoy tender will be forced to find new vocations.

For years the lighthouse keeper has been one of the most picturesque figures along our coasts. Isolated for months at a time from the world, many tales have been told of the heroism of the men who trim the lamps that guide the mariner to safety.

While the lighthouses along our coasts may be still utilized, the lights will be automatically cared for, only requiring inspection and attention at long intervals.

Acetylene, in its various forms, is the only commodity yet produced that will give a light next in power to that of the sun. By its use, inventions have been perfected to produce lights for a continuous period of from one to five years or more, according to the amount of fuel installed.

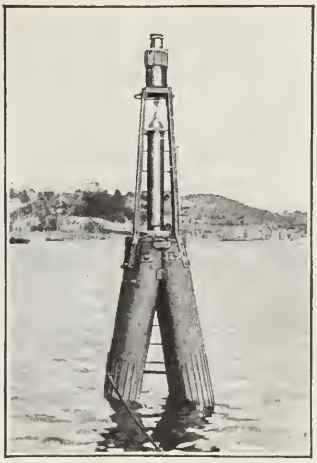


An Acetylene Beacon Buoy Which Has Been in Two Collisions with Ocean Liners near Greenville Pier, New York Harbor. Although Dragged Under Vessels' Bottoms, no Damage Was Done to Either Lighting or Whistling Functions

The most wonderful light in the world, and now in use by the United States government, is the one invented by Delan, the Swedish scientist. It is produced by acetone gas, and has a "human working" sun instrument containing a glass tube of several rods of varying reflective powers which automatically opens and closes the valve in accordance with the light absorbed. In other words, the light burns continuously until affected by the heat of the sun, when it goes out, only to be revived at dawn. It also contains a flashing apparatus in the lantern.

Two other types of acetylene lights have also been adopted by the Department of Commerce and Labor, which has charge of the work of

Goodyear Automatic Acetylene and Whistling Buoy—Will Burn a Year Without Attention



Pile Beacon Acetone Light—Will Burn Three Months at Cost of Two Cents per Day

Wilson Combination Gas and Whistling Buoy, Lightship Type—Emits Powerful Blasts

lighting the coasts. These are known as the Wilson and Goodyear automatic lighting and whistling buoys and beacons. The Goodyear type generates its own gas by means of a mechanical device inside of the buoy, controlled by pressure of acetylene gas, and a spring feeding the calcium to the water.

The Wilson type generates its gas also by water fed to the carbide. The action of the water at the bottom of the buoys, forced through pipes to the whistle, causes perpetual blasts of warning. The power of the whistling apparatus is about six times greater than that of the largest sized Courtnay whistling buoy.

As an aid to navigation these buoys are equal to lightships which carry crews; indeed so far as knowledge of experts extends, lightships have not as yet been equipped with as powerful lights. Mariners have observed these lights at a distance of 20 to 30 miles.

Both the Wilson and Goodyear inventions are adaptable to all kinds of coast lighting apparatus. These lights are now in use on the coast of Connecticut, in the harbor of New York City, at Cape Henry on the Virginia coast, and at Florida points which are dangerous.

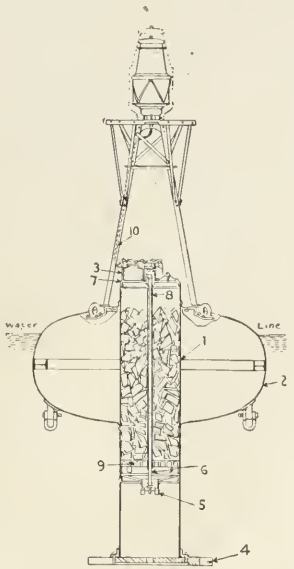


DIAGRAM OF WILSON ACETYLENE BUOY

1—Gas Generator; 2—Float Chamber; 3—Purifier Chamber; 4—Counterweight; 5—Valve; 6—Valve Stem; 7—Generator Head; 8—Guard Pipe; 9—Grate; 10—Gas Pipe

In the near future the government will replace the present lights on the Pacific coast along California, Oregon and Washington with the acetone or acetylene types. These changes, like those recently made on the Atlantic coast, will only apply to beacon, buoy and lightship lights. It will be some time before the acetylene lamp will displace the old lighthouse keeper. That change, however, is bound to come.

The general adoption of these new inventions of sea-warning lights will mean the saving of many thousands of dollars to the government annually. These "human" devices will automatically do the work of several hundred men now employed in earlier systems of lighting the paths of navigation.

Acetone gas, or dissolved acetylene, Delan's wonderful invention, is stored in steel tubes (accumulators) filled with a porous material, soaked with acetone, a volatile liquid, formed by the distillation of wood and many kinds of organic substances.

One volume of acetone dissolves 25 volumes of acetylene at 15° C, and atmospheric pressure, the solubility increasing in proportion to the pressure, so that at a pressure of 10 atmospheres, one volume holds 250 volumes of acetylene, and at 12 atmospheres about 300 volumes of the gas. The proportion of porous material and acetone in the accumulators is always fixed, so that one volume of the accumulator holds 100 volumes of acetylene at a pressure of 10 atmospheres.

Several accumulators combined form a larger gas store, capable of supplying gas for a longer time; the life of one accumulator or tube being from three to four months.

In the light apparatus, the governor reduces the comparatively high and always varying pressure of the gas, leaving the accumulator, to a constant pressure and one more suitable for the burner.

The flashlight apparatus of the Delan invention produces flashes by automatically admitting to the burner precisely the quantity of gas required for a flash, and then by keeping the gas outlet shut during the eclipse until the next flash. Existing apparatus in this line can never give more than 50 flashes per liter of gas; on the other hand, the Delan flashlight apparatus gives up to 2,500 flashes per liter. The flash can be reduced to 1/10 of a second with constant gas pressure all the time the flame is burning. The gas is never throttled, which would mean gradually reduced pressure and varying size of flame. Even during the very shortest flashes its flames are constant. The most important feature of this apparatus is a magnetic device that facilitates the instantaneous cutting off of the gas.

Simply by turning two screws, the apparatus is adjusted so as to give single or double flashes of different character.

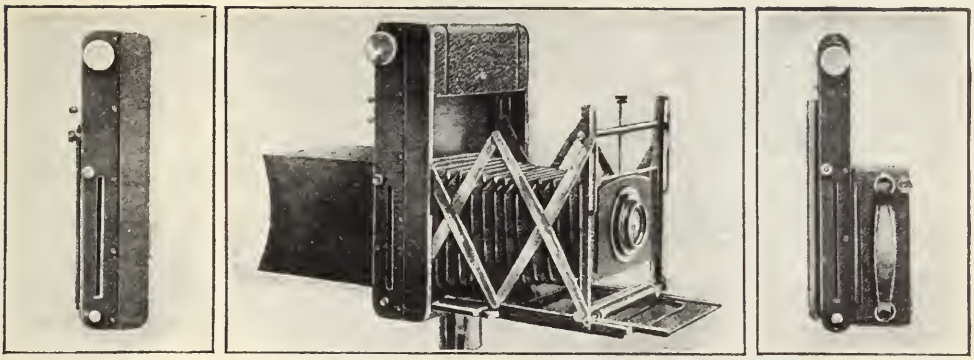
Ordinary steatite burners are used with an air supply, on the Delan system. These burners have proved very solid and reliable. The acetone gas itself possesses, moreover, some qualities that add greatly to the permanence and reliability of the burner.

The sun valve is a device facilitating lighthouses, and buoys to be automatically extinguished by sunlight. At sunrise this device, coupled between pressure-reducing valve and flashlight apparatus, closes the gas outlet. At sunset the gas is admitted again to the flashlight apparatus and to the burner. It must be accentuated that this device, the sun valve, is put into operation only by the sunlight, and that no change of temperature, storms, etc., interferes with its successful action. Tests in variable climates have shown a saving of from 30 to 40 per cent of gas.

IMPROVED GERMAN HAND CAMERA

The camera recently perfected in Germany and shown in the accompanying illustrations, is only about half as big and heavy as the reflex cameras now in use for taking pictures of the same size. The plates are carried in a magazine above the box, and the image is seen at the back instead of being reflected upward by a mirror, so that the picture is taken on the line of vision.

When the box is opened the lens springs instantly to universal focus, and the camera is ready for an exposure. The plate drops down from the magazine before the shutter moves and is returned to the magazine again after exposure. The plates are numbered automatically as they are exposed so that they can be identified during development and afterward, and there is no danger of developing an unexposed plate. Two exposures cannot



Three Views of New German Hand Camera

be made on the same plate, nor can plates be wasted by forgetting to expose or unintentionally drawing the slide when the lens is uncovered. Furthermore, if the operator has forgotten to wind the shutter or draw the slide, the camera becomes inoperative until these are attended to.

The focal-plane shutter is directly in front of the plate and a scale on the outside indicates the width of the slot at all times. As the slot has already traversed the depth of the magazine before it begins to expose the plate, it is moving at maximum speed during exposure. Nearby objects are focused upon by moving the base of the camera. The angle of view is 90 degrees. A special combination of lenses for all classes of work is employed. Instead of carrying-straps, three threaded holes are provided into which can be screwed a leather handle for carrying the camera and holding it while focusing.

"NORTH DAKOTA" ACCIDENT WILL NOT CHECK TESTS

The development of the use of petroleum as an auxiliary fuel on war vessels will not be checked despite the fire on the battleship "North Dakota," which resulted in the death of three men. The settling tank, which has a capacity of 400 gal. of oil, is, on the "North Dakota," directly over the boiler, and the ignition of oil which leaked from the tank and flowed into fire room No. 3 caused the fire. This room is under one of the magazines and the three men who lost their lives were in the room and fought the flames to prevent the heat being communicated to the explosives above them, in which event the entire ship might have been destroyed. The fire room was flooded as soon as an alarm was given and the three heroes were drowned. The men are believed to have been unconscious from burns when the inrush of water caught their bodies.

As a result of the investigation of the accident the settling tanks will be removed from the vicinity of the fire room and the boilers so that any small leakage will not expose the oil to heat sufficient to set it afire. Naval experts state that in the course of experiments of this kind accidents are inevitable and while deplorable, are not to be permitted to stop progress. It is pointed out that the "North Dakota" plant was a reproduction of the devices adopted by foreign navies and has been in successful operation on no less than 50 warships.

¶Barney Oldfield with his Benz car established a new world's automobile record by making a mile on the Minneapolis circular track in 49 sec.

¶The Southern Pacific Railroad has just inaugurated a freight service over its 7,600-ft. double-track bridge across the southern end of San Francisco Bay.

Fort Wayne Trolley Wreck, Showing One Coach Split Through by Heavy Interurban Car

FORTY PEOPLE KILLED WHEN TROLLEY CARS COLLIDE

Forty of the 60 passengers on an Indiana trolley car were killed and most of the survivors severely injured by the collision of an empty coach of the heavy interurban type with a lighter car loaded with pleasure seekers on their way from Bluffton to Fort Wayne to attend a fair, September 21. The empty car was moving at the rate of 40 miles an hour and the crowded car was making 25 miles an hour when the collision occurred. Misinterpretation of orders on the part of the motorman of the empty coach, who died from his injuries, is given as the cause for the wreck. The cars met on a curve near Kingsland, the empty coach plowing its way through the other car.

RESERVOIR WIPES OUT AN ENTIRE VILLAGE

There have been instances of villages being wiped out by the breaking of great water reservoirs, but in this instance a village is wiped out by the plans for the construction of such a reservoir, not by its destruction.

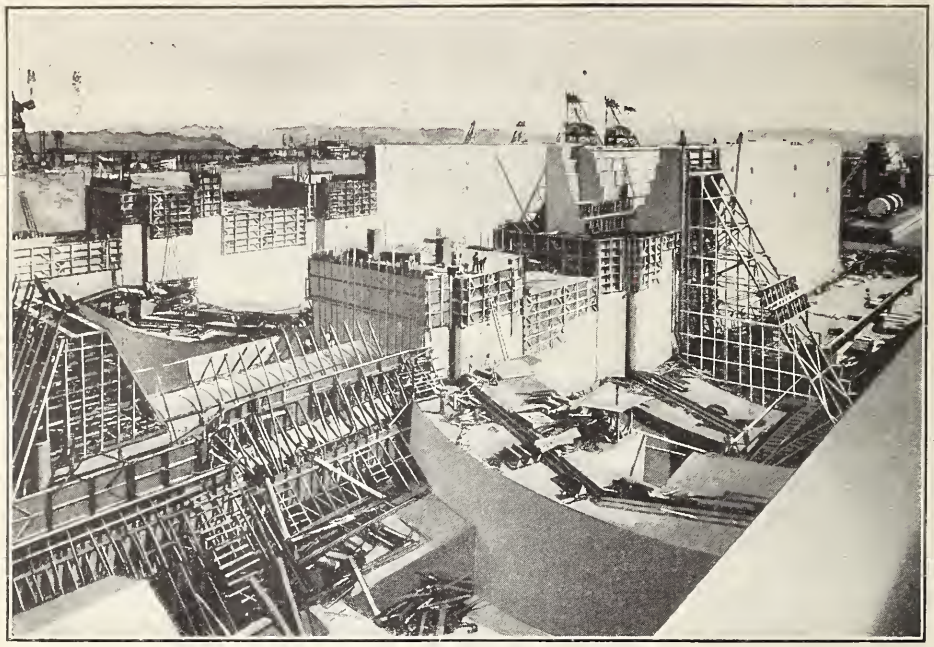
The storage reservoir is to be constructed to regulate the flow of the Black River, in Oneida County, New York, and the village to be wiped out is Hawkinsville. The dam will be an earthen embankment, 130 ft. high, and 1,500 ft. long, with a masonry spillway. The survey made by engineers of the New York State Water Supply Commission shows that the dam will hold back nearly 6,000,000,000 cu. ft. of water, creating a lake 5½ miles long and 2 miles wide.

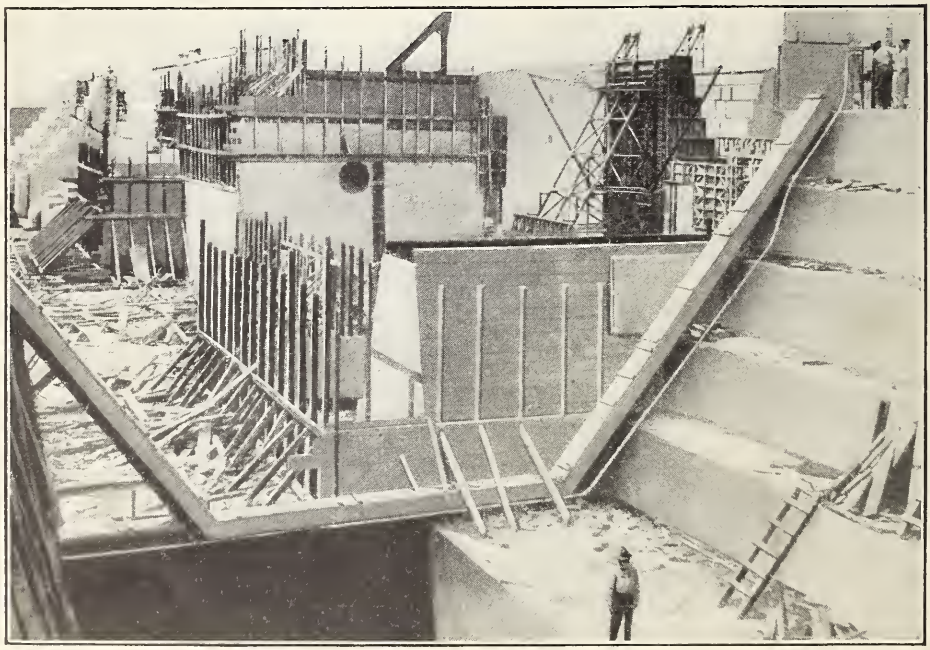
EARTH SWALLOWS A STEAM ROLLER AT ONE GULP

The citizens of Detroit were recently surprised by the sight of a steam roller literally swallowed by the earth. The roller was of the type usually employed in leveling new asphalt streets and for like purposes. It was being trundled through one of the main thoroughfares when it suddenly disappeared, a hole 15 ft. wide, in the paving, marking the place where it had sunk.

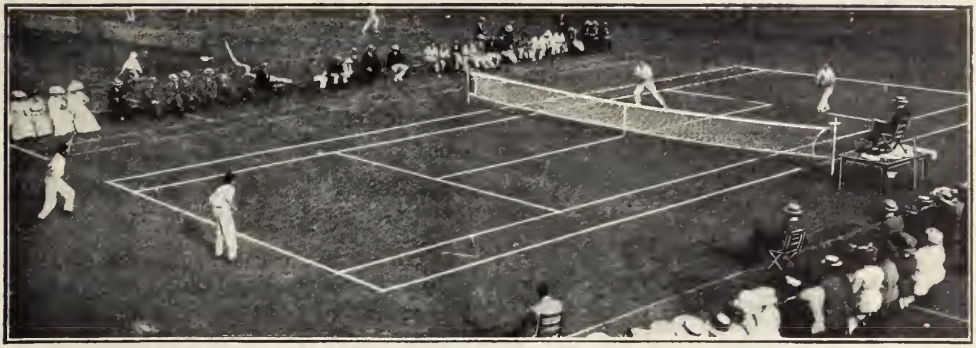
The hole was 25 ft. deep and the accident was caused by a washout under the street due to a leaky sewer pipe which left but a crust of the paving over the deep hole. The roller was the first heavy vehicle to pass the spot after the washout. Quick action on the part of the bystanders resulted in the rescue of the engineer and fireman of the roller who were only slightly bruised.

Two Views of Steam Roller Which Sank Through Detroit Pavement





THESE new pictures convey a more adequate idea of the immensity of this, the world's most ambitious undertaking, than any before taken. They show the mammoth construction work on the Gatun locks of the Panama Canal. Note the water-main openings in the lock wall in the upper view, the black circular spots which resemble port-holes. Consider that these openings, which look like pinheads compared with their surroundings, are 16 ft. in diameter and you get a conception of the magnitude of the concrete work. The completion of the first year of concreting work on the dams shows that 655,083 cu. yd. have been placed.



Note Perfect Line of Top of Net

DEVICE KEEPS TENNIS NETS TAUT

An invention of great interest to tennis players is seen in the accompanying photograph of the finals of the intercollegiate tennis tournament held in Pennsylvania during September. Formerly, the tennis net was tightened by being fastened to the poles at either end, these poles being then placed in their sockets in the ground. But as there was nothing to keep the net taut, it sagged after a short while, owing to the strain on the poles.

A sagging net has always been a cause of trouble to tennis players both in tournaments and private games. The device, just patented, is very simple but keeps the net perfectly taut until released. The net is stretched simply by turning one of the iron poles to which it is attached. When the cord has been turned as far as it will go and the top of the net is held perfectly straight, the pole is locked in place by inserting it in a ground socket provided with teeth that meet corresponding recesses in the bottom of the pole. When these teeth engage, the net cannot sag until the pole is pulled from its socket.

¶Peary's arctic ship "Roosevelt" has been purchased by John Arbuckle, who may add it to his wrecking fleet. Arbuckle is one of the coffee magnates and is also interested in salvage operations.

KITE THAT IS BUILT LIKE THE "DEMOISELLE"

A kite, closely resembling a Santos-Dumont Demoiselle monoplane attracted considerable attention at the aviation meet at Asbury Park, N. J. The kite was built by Thomas C. Brown of Asbury Park, using the measurements of the "Demoiselle" as a guide, and developed a lifting power of 100 lb. The framework was made of bamboo rods covered with unbleached muslin. The forward planes measured 6 ft. by 10 ft. each and the rear or stabilizing plane, 2½ ft. by 6 ft., which gave the machine a lifting surface of 135 sq. ft. The kite was flown with a light braided sash cord.

Kite Patterned after Santos-Dumont Monoplane

CLOTHES DRYING APPARATUS

Clothes dryers may become as common in modern homes as laundry tubs,

One Type of Clothes Dryer

and with as good reason, especially in climates where the long and cold winters make drying outside a difficult and unpleasant task. Several concerns are building dryers of sizes suitable for private residences as well as for hotels or clubs. In some of them the waste heat from the laundry stove is used to dry the clothes, while in others steam heat or gas is utilized.

MILLION-BARREL RESERVOIR FOR OIL FIELDS

Two concrete reservoirs for oil, said to be the largest in the world, are in the course of construction at San Luis Obispo, California, each of which will have a capacity of 1,000,000 bbl. of oil. The reservoirs are to cost half a million dollars, and the oil to fill them will be piped from the Bakersfield, Maricopa, Coalinga and Midway wells. When the tanks are filled, the oil in them will flow, by gravity, to the pumping station at San Luis Obispo, and from thence will be pumped directly to the tank steamers at Port Harford.

The reservoirs are being constructed on a rush order and an army of men is employed in the work. There were 300 teamsters, each driving two-horse teams used in excavating 160,000 cu. yd. of earth in addition to the 300 other laborers employed in other parts of the work. A million and a half feet of lumber will be used for the construction of the roof and supports of

Panorama of Million-Barrel Oil

the reservoirs, and the walls require 18,000 bbl. of cement which will be made into 12,000 cu. yd. of concrete.

GASOLINE-ELECTRIC AUTO FOR DESERT WORK

The problem of heavy haulage through the arid regions of the American southwest has resulted in a very interesting type of combination gasoline and electric auto-truck. Some 80 miles south of Marathon, Texas, and about five miles beyond the Rio Grande in Mexico, is a mining company, whose products of zinc and lead have to be transported to the railroad at Marathon.

The first step was the building of an aerial tramway, 6½ miles long extending from the mines, over the Rio Grande, to the Texas side. This was built at a cost of $110,000. Then the company had to determine the means of getting the ore through to Marathon. The difficulties to be met with consisted, chiefly, of the long distance, the absolute absence of fuel of any sort along the route, and the lack of water, there being none for one stretch of 40 miles.

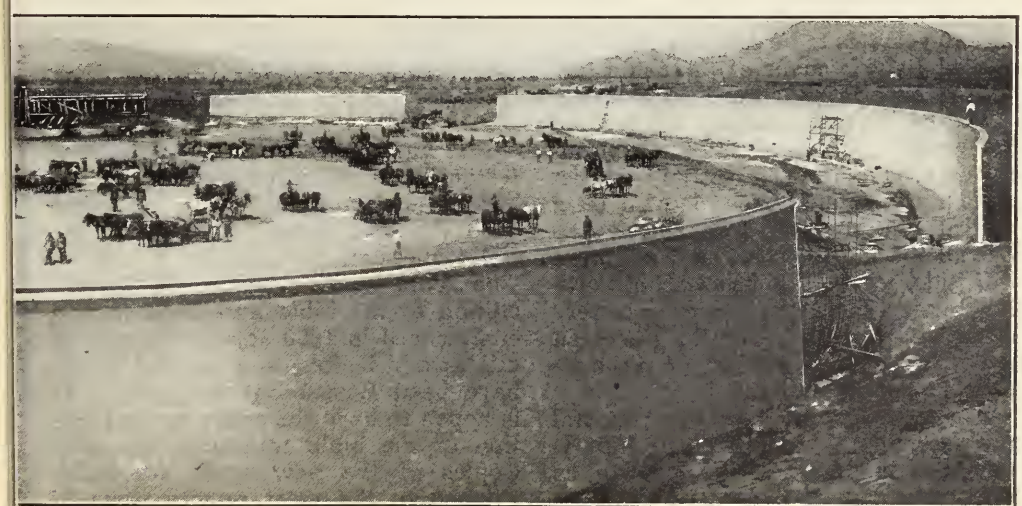
The traction expert called in by the company decided that neither a gasoline nor an electric truck would be satisfactory, but that a combination of the two that would eliminate the batteries of the electric truck and the gears and clutches of the gasoline type, would prove satisfactory.

Consequently, a truck was built that is said to be successful in operation. It has as a power plant a 4-cylinder, 6 by 6½-in. gasoline engine, direct connected to a generator. The capacity of the truck is 15 tons of ore, with which load it will make a speed of more than 4 miles an hour.

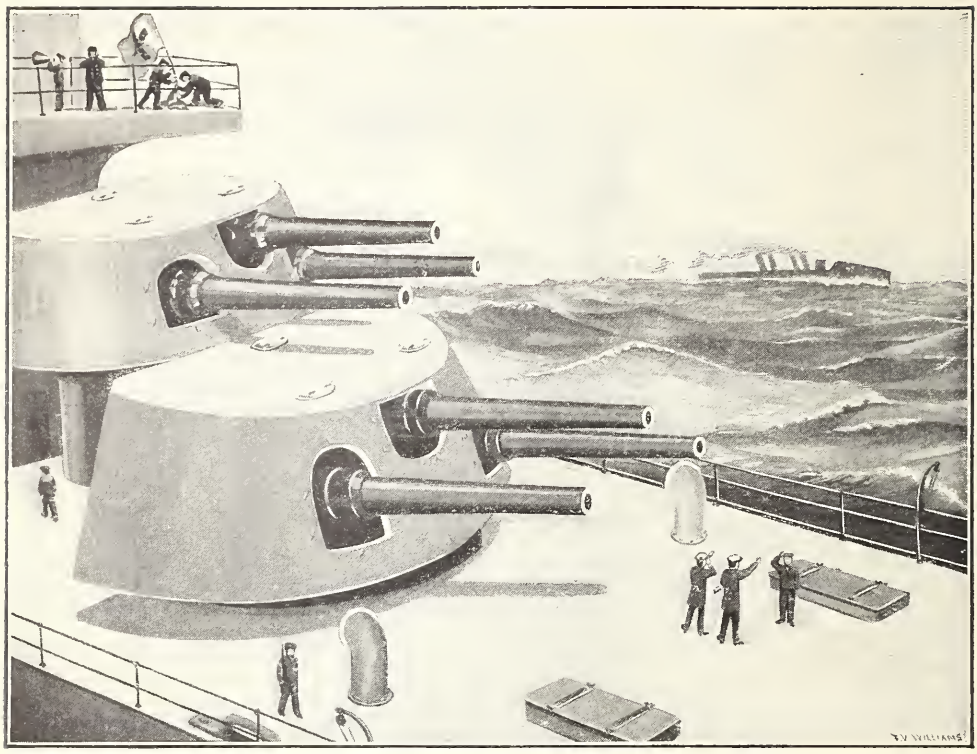
CUNARD MAY BUILD A 1,000-FOOT LINER

It is hinted in England that the Cunard line will construct a liner 1,000 ft. or more long, but the actual dimensions have not yet been given out. One of the officials of a British shipbuilding company has made the statement, however, that the next Cunarder will not only be the largest ship ever built, but the largest ever thought of.

The White Star line's "Olympic," and "Titanic" are 850 ft. long over all, and have a beam of more than 90 ft., so that it is not unreasonable to presume that the ship contemplated by the Cunard line will be at least 1,000 ft. long, and have a beam of more than 100 ft.



Reservoir in Course of Construction



Battleship with Three-Gun Turret

RUSSIA AND ITALY TO MOUNT THREE GUNS IN TURRETS

The practice of placing only two guns in each turret or barbette, which has been universal in all navies for the past 40 years, is to be discarded by Russia and Italy in favor of three-gun turrets, if experiments prove satisfactory.

The entire main battery on each of the new Russian battleships, which includes twelve 12-in. guns, will consist of four three-gun turrets, located on a central line running fore and aft so that all the guns can be fired on either broadside. This, it is believed, will give the Russian ships as powerful a battery as the six-turret ships of the American and British navies, and with a displacement of 3,000 tons less.

The idea as adopted for experimental purposes on the Italian battleships is not quite as radical as the Russian, as only three out of five turrets will be provided with three guns, while the other two turrets will have the present arrangement of two. This will give the Italian ships a main battery of 13 guns.

CHINESE TRANSLATION OF BIBLE FINISHED

The final revised edition of the new testament translated into Chinese has been issued from the press, together with the first completed book of the old testament, the Psalms of David. The work of translating the revised edition of the bible into Chinese was commenced in 1890 at a conference of missionary bodies, and several books have been turned out each year. It is hoped to have the entire revised edition of the bible translated by 1915. Copies of the new work are being shipped to the most remote parts of the Chinese empire.

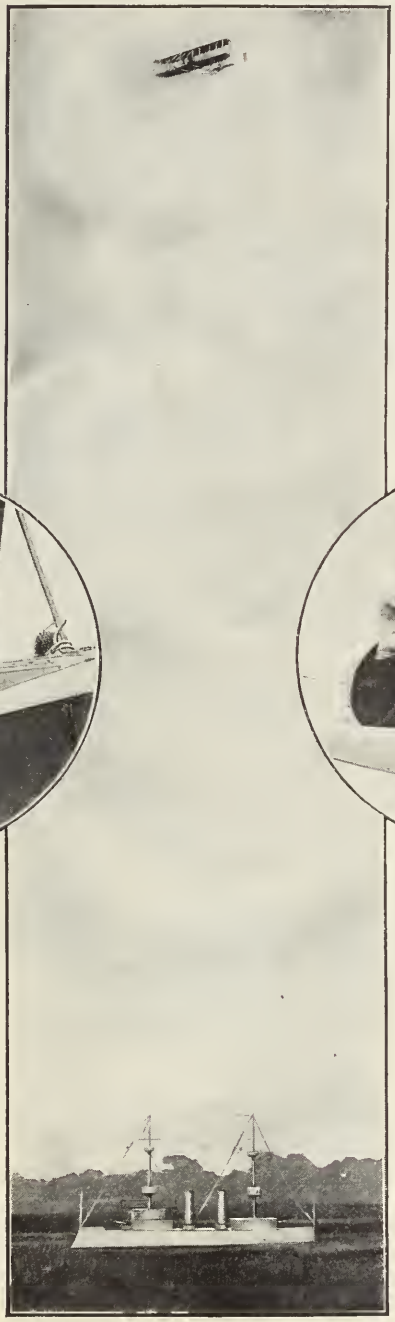
EVENTS OF THE MONTH IN AERONAUTICS

A CENTURY after Napoleon fought the snows and crags of the Alps for two bitter weeks to march his army into Italy, George Chavez, a Peruvian, accomplished the passage in an aeroplane in 40 minutes. The aviator paid for his daring with his life.

Chavez and Henry Weymann, an American, essayed the task of crossing the Alps in aeroplanes, starting from Brieg, Switzerland, with Milan, Italy, as their objective. They were to fly over the mountains pierced by the Simplon tunnel, and the length of their course was estimated at 75 miles. From Brieg to Domodossola, the portion of the trip made by Chavez that included the mountain passes, the distance was estimated at 25½ miles. After several attempts which failed because of contrary winds or fog, they started on the morning of Sept. 23. Weymann was compelled to descend after two trials. Chavez made the perilous journey at the first trial, soaring to a height of more than 8,000 ft. to clear the snow-capped peaks.

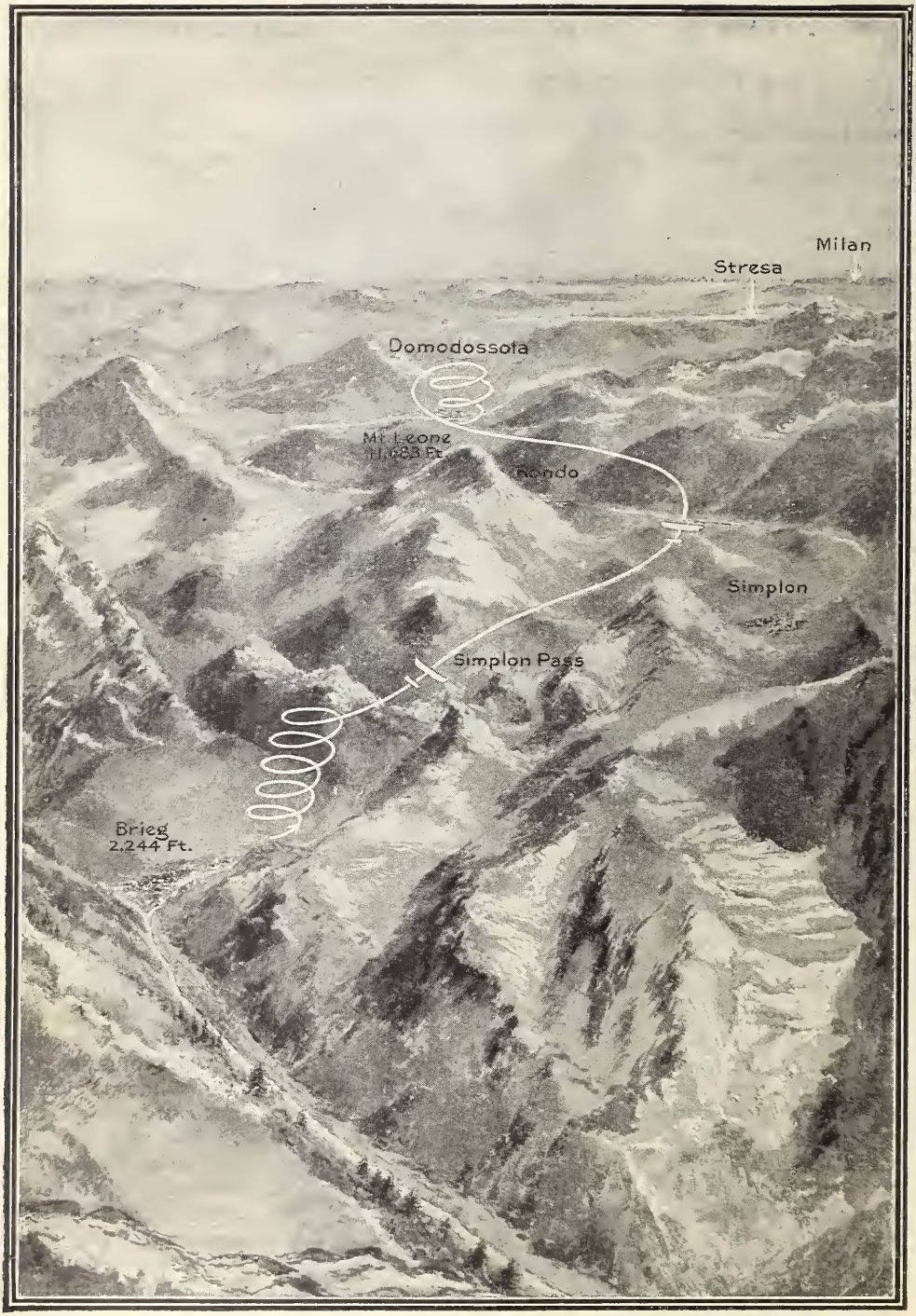
At Domodossola, Italy, when he had completed the most dangerous part of his journey, Chavez attempted to descend. His monoplane capsized when he was 30 ft. from the ground, and he was thrown, the machine falling on him and inflicting injuries from which he died four days later. A prize of $20,000 was the reward offered for the feat. While Chavez did not complete the trip to Milan,

George Chavez, the Peruvian Aviator Who Crossed the Alps



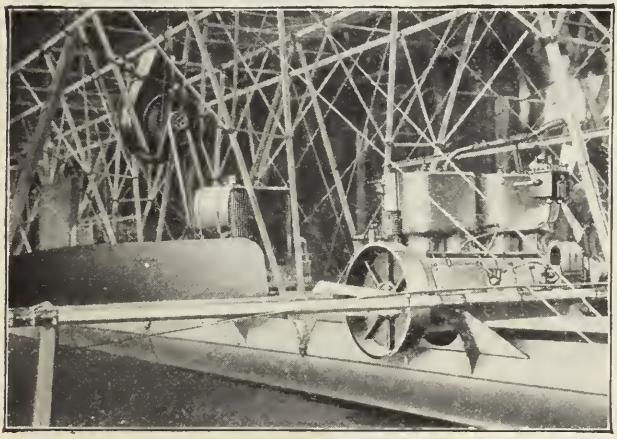
Ralph Johnstone Dropping Imaginary Bombs on a Model Battleship at the Boston-Harvard Meet

Leon Morane, French Aviator, Who Held Altitude Record of 8,471 Ft.



Route of the Flight of George Chavez, the Peruvian Aviator Who Lost His Life after Successfully Crossing the Alps

Where the Airship "America" Was Built at Atlantic City



Engine and Propeller Shaft of the Wellman Airship

Propeller of the Airship "America," in which Walter Wellman Plans to Sail Across the Atlantic

the donors of the prize agreed to pay half of it and $10,000 has been paid to his brother.

In addition to crossing the Alps, Chavez set a new altitude record by soaring to a height of 8,792 ft. in one of his trials just before starting on his fatal journey. Leon Morane, the French aviator, had set the mark at 8,471 ft. just a week previous. On Oct. 1, in France, Wymalen went still higher, reaching an altitude of 9,121 ft.

The Boston-Harvard aviation meeting at Squantam Field, Mass., ended with the laurels in the possession of the English aviator, Grahame-White. He was the biggest prize-winner, with Ralph Johnstone second, Walter Brookins third, Glenn Curtiss fourth, and Charles F. Willard fifth, in point of the amount of money won. The better part of the prizes won by Grahame-White were from speed tests, in which he outdistanced all his competitors. The only world's record made during the meet was credited to Ralph Johnstone, who, in a Wright biplane, established a new mark for accuracy in landing by putting his machine within 5 ft. 4 in. of the mark. Johnstone also made a new American record for duration and distance by remaining in the air 185 min. 40 sec., covering a distance of 101 miles, 389 ft. The Roe triplane, which was tested for the first time in the United States at this

meeting, fell after flying 25 ft. and was smashed.

Two airmen besides Chavez lost their lives during the month of September through their devotion to aviation. Edmund Poillot, a Frenchman, fell from a height of 60 ft. at Paris, Sept. 26, and died within 20 minutes. In Germany, Flochmann died Sept. 29 from injuries received in a fall of 150 ft. at Muelhausen, Sept. 28. The King of Italy heads the list of those injured, his majesty having thrown himself to the ground and sustained several slight bruises in avoiding an aeroplane at the Milan meet, Sept. 28. The most curious accident of the month that can be assigned to the aeroplane occurred in Chicago, Sept. 28, when a man, who was watching Brookins maneuver his Wright machine along the lake front, fell through the chimney on which he was standing, a part of which collapsed. It was necessary to tear out a section of brick wall to get him out of the chimney, into the depths of which he had fallen about 60 ft.

Charles K. Hamilton was seriously injured by falling 50 ft. at Sacramento, Cal., Sept. 9. At Milwaukee, Sept. 17, a Wright machine, driven by Hoxey, was swerved into a crowd by a sudden gust of wind and eight persons were hurt. Count Zeppelin's fifth dirigible was destroyed by fire while it was being housed after an unsatisfactory trip of 56 miles, Sept. 14. The carelessness of the crew is blamed for this accident. The engineers were cleaning the bearings, and in some manner a spark fell into an open gasoline tank. An explosion followed, and the flames were communicated to the structure, which was totally destroyed.

In America as in Europe, cross-country flights have called forth the best recent efforts of the aviators. Walter Brookins set a new record for continuous flight, Sept. 29, when he sailed from Chicago to Springfield, a distance of 187 miles, with but two descents for fuel. His actual flying time was 5 hr. 49 min. For two days previous to this flight he astonished and entertained the people of Chicago with spectacular air trips over the city, the first that have ever been made there.

The New York-Chicago flight for a prize of $25,000 has attracted aviators from Europe and America. The event was scheduled to take place Oct. 8, and for a week before that trial flights were had in connection with an aviation meet at Hawthorne, a Chicago race course. Among those who entered for the race, a list including Grahame-White, Curtiss, Willard, Brookins and others, was John B. Moissant, who succeeded in reaching London, Sept. 6, on his flight from Paris with a passenger.

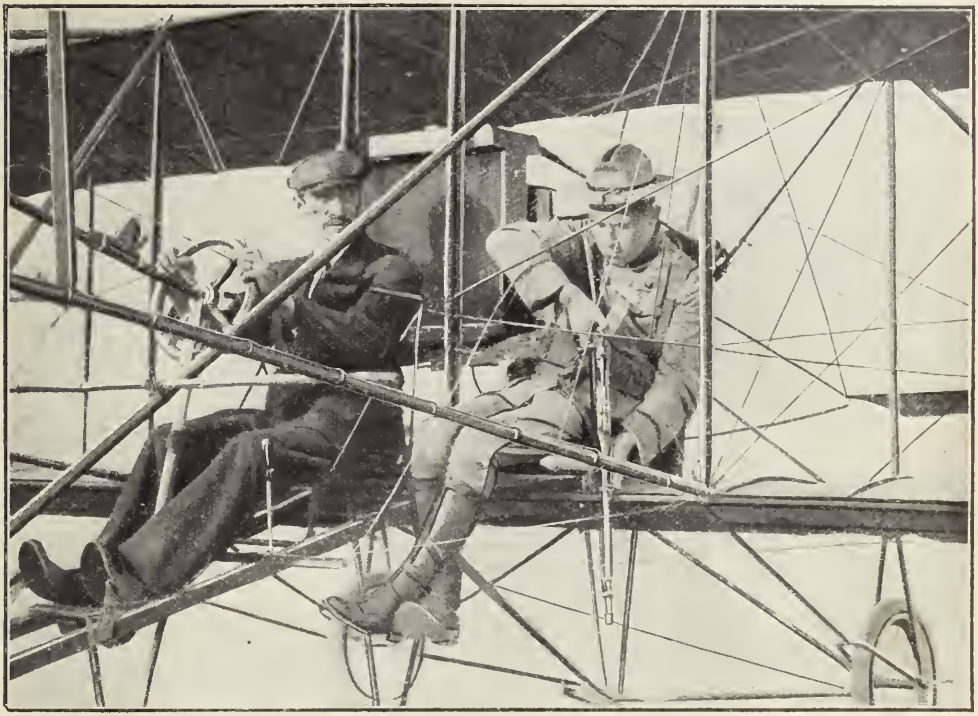
Robert Loraine, the actor-aviator, fell into the Irish Channel 60 yd. from the coast of Ireland, Sept. 11, in his attempt to soar from Holyhead to Dublin. His flight is recorded as a success.

A prize of $10,000 has been offered the aviator who will be the first to fly from Rochester, N. Y., to Detroit, Mich., and the London Daily Mail has offered a prize of $50,000 to the aviator who makes the best time in a 1,000-mile race over England and Scotland next July.

Decided advances have been recorded in the military development of the aeroplane. In France two machines were used at maneuvers with great success. Both were monoplanes, and one of them established a new speed record, carrying a passenger, of 56 miles per hour. Information regarding the movements of an enemy's force, that would have required a day of hard scouting for men mounted on cavalry chargers, was obtained in an hour. In Germany the military authorities had poor success with their dirigibles, the two used being responsible for several tactical errors on the part of the troops in the field.

France is reported to be contemplating the use of aeroplanes in an express service in Africa, a corps of aviators having been assigned to work across the desert and establish sites for repair stations.

Women entered the field of the avia-



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Lieut. Jacob E. Fickel, 29th U. S. Infantry, Demonstrating the Practicability of the Aeroplane as an Aid to Sharpshooters, in a Flight with Glenn Curtiss at Governor's Island

The Venerable Author of "Darius Green and His Flying-Machine," J. T. Trowbridge of Boston, Being Introduced to Grahame-White, the English Aviator

Ralph Johnstone, American Aviator, Who Made Record for Accurate Landing

tor in the United States for the first time. Society leaders, actresses and the wives of well known aviators made short flights, as passengers, during the month of September and one woman steered her own machine in a short flight.

The balloons "New York," "Buckeye" and "Miss Sophia" qualified as American contestants in the international balloon race, scheduled Oct. 17 from St. Louis. Nine balloons started in the qualifying contest.

The transatlantic flight of Walter Wellman in the dirigible "America" has been planned in the most practical

manner. Mr. Wellman has arranged to start from Atlantic City, and the navigation of his ship has been placed under the charge of F. Murray Simons, a merchant-marine officer who secured special leave of absence from the Atlantic line by which he is employed in order to make the trip.

MACHINES FOR PICKING CRANBERRIES

The cranberry industry is a very important, but comparatively little known, American activity in which mechanical devices have lately brought about a revolution. Ingenious machines have been introduced for harvesting the crimson berries and for sorting or separating the fruit, with the result that hand labor has been to a great extent eliminated. By way of illustrating the transformation that has been worked, it may be cited that the "Cranberry King," who formerly employed more than 1,100 pickers on his great "bogs" on Cape Cod, now handles his crop,—thanks to the aid of the machines,—with less than one hundred men.

The invention of these machines, which simplify the operations of the cranberry growers, is also resulting in a great expansion of the territory planted in cranberries. America is the only country in the world where cranberries are cultivated, and the activity is restricted largely to the states of Massachusetts, New Jersey and Wisconsin; but that a goodly supply of the delicacy is required to satisfy the American appetite may be surmised from the fact that the Cape Cod district alone produced last year more than one-third million barrels of cranberries. Bearing cranberry bogs sell for from $600 to $1,200 per acre, but successful growers net all the way from 10 to 100 per cent on their investment every year.

The most interesting of the new machines are designed for picking the berries. These grow close to the ground on vines that are always so tangled as to resemble a miniature jungle and to hide the berries from view except on close inspection. One style of picking machine resembles a small wooden box, of convenient size to be held in one hand and with jaws which open and close by the pressure of the hand. In operation, the jaws are opened and the machine thrust into the tangle of cranberry plants. Then the jaws, each armed with a row of teeth, are made to close and, when the machine is withdrawn, the berries are instantaneously stripped from the stems, remaining in the receptacle until the jaws of the machine are again opened and the berries emptied into the waiting bucket or tray.

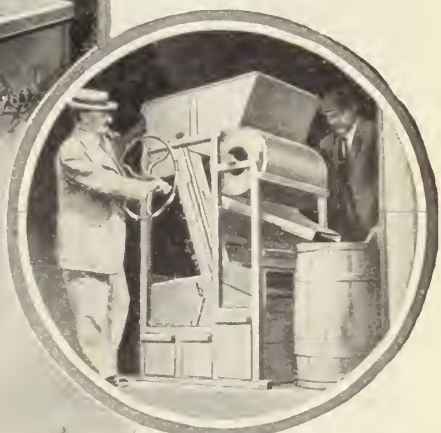
The other mechanical picker, which is even more extensively used, consists of a large scoop-like receptacle, the lower side of which is made up of a series of iron prongs set fairly close together. This scoop is shoved into the tangle of cranberry vines, and when it is drawn back, it is found that the vines have slipped between the close-set prongs but have left the berries reposing in the scoop. The operations of these two types of picking machines are ably supplemented by the "separator,"—a hand-operated mill which screens the berries as they come from the bogs and removes all leaves, twigs and other foreign matter.

¶The muzzle of one of the 12-in. turret guns of the battleship "Georgia" was blown off at target practice, Sept. 22, but no one was injured and no other damage done.

¶The rubber harvest for 1910 amounted to 39,363 tons, according to figures prepared by a German expert, an increase of 1,115 tons over the crop of the 1908-09 season.

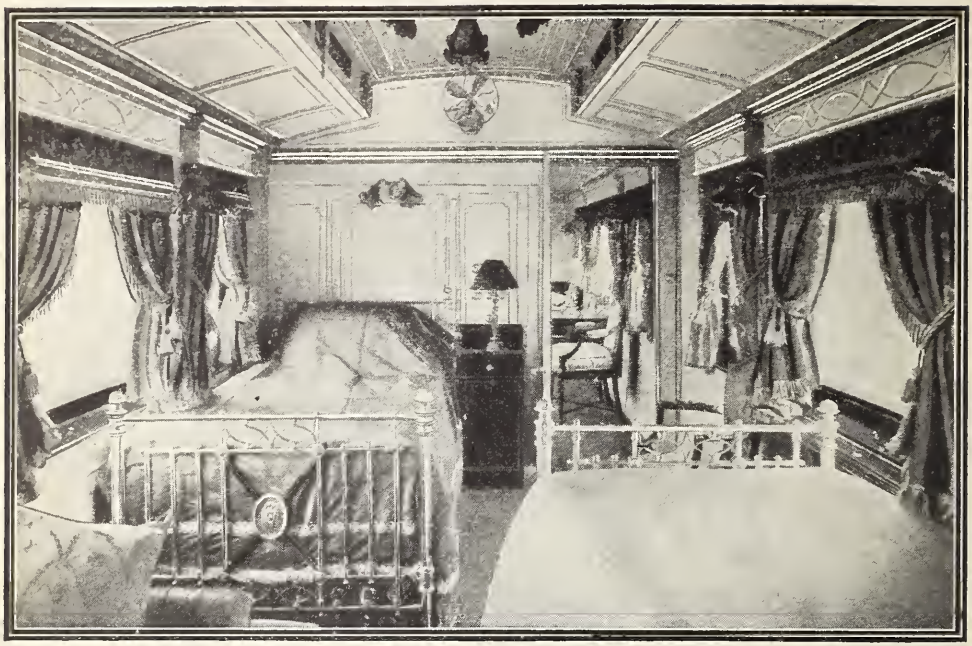
Emptying Cranberries from "Picking" Machine

Cranberry Picker with "Clipping" Machine

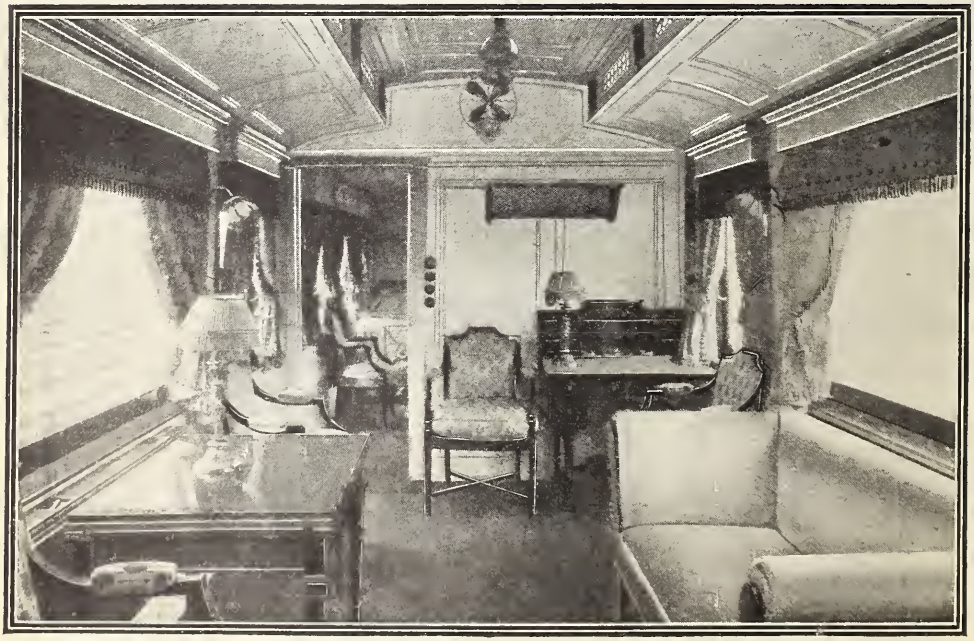


"Separator" for Handling Berries as They Come from the Bogs

One Hundred Men with These Machines Displaced 1,100 Who Picked by Hand



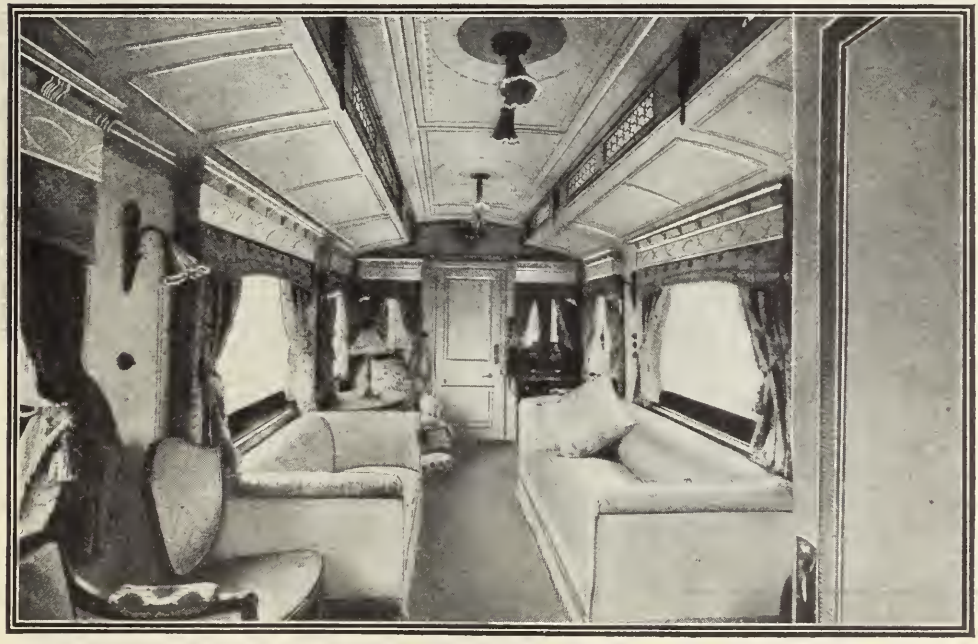
The King's Bedroom—Prince of Wales' Bed in Foreground



The King's Sitting Room

VIEWS OF INTERIOR OF THE NEW ROYAL

The Bedroom of Queen Mary



The Queen's Sitting Room

TRAIN FOR ENGLAND'S KING AND QUEEN

The Sinking of the "Pere Marquette No. 18"—"No. 17" Coming to the Rescue

WHY DID THE "PERE MARQUETTE" SINK?

By J. Q. ROBERTS

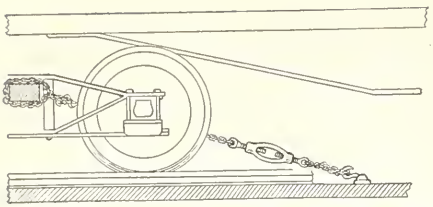
SHORTLY before midnight on Sept. 8, the huge steel car ferry "Pere Marquette No. 18" left her slip at Ludington, Mich., with a cargo of 29 loaded freight cars, bound for Milwaukee, Wis. She was built but a few years ago and had been inspected that very day by two members of the government steamboat inspection service and declared to be as sound and seaworthy as any craft on the great lakes. She was equipped with every safety device, and yet she foundered in the middle of Lake Michigan a few minutes after seven o'clock the following morning.

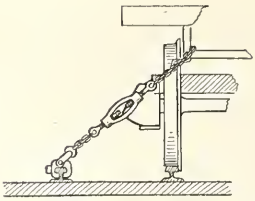
Twenty-seven members of the crew were drowned, including the captain and the other officers. Thirty-two persons were saved, yet not one of them knew why this staunch vessel sank, and it is doubtful if even the officers knew definitely the cause of the tragedy. Great ships have gone to sea and never returned, and their fate has remained a mystery. Storms and fire have obliterated many of them, yet there are few cases in marine history in which the survivors have not been able to account for the disaster. But in this case, even after an extended investigation in the course of which every survivor was questioned, the steamboat inspection service reported that it was unable to determine the cause.

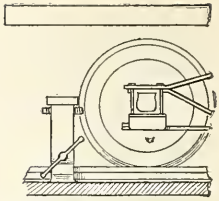
An idea of the thorough seaworthiness of the ship is afforded by the fact that the officers, even after it was known that her lower and after compartments were filled with water, refused to leave her, but had confidence in her ability to remain afloat. The government report on the disaster censures Captain Peter Kilty for not deserting her, but men who have navigated the Great Lakes for many years, and have been masters of vessels of the same class, declare that he was justified in his confidence.

It is known that at three o'clock on the morning of the ninth, an oiler, going back to oil the bearings of the main shaft, found the compartment under the flicker full of water. He reported this to the engineer who, in turn, reported to the officer on watch that there was something wrong aft, that the pumps were on and the water was gaining on them. The first officer went aft to investigate and returned to the pilot house, remarking to the wheelman that "only a deadlight was busted, and it didn't amount to much." The captain was then called and he took charge of the ship. Fragmentary statements made by survivors, seem to indicate that within a short time three other deadlights in the flicker were taking in water. These deadlights were 12 in. in diameter, and it is easy to realize how four of them, by this time submerged below the waterline by the weight of the water already in the compartments, would ship a volume of water with which the pumps could not cope. The crew began to push cars into the lake in an effort to lighten the stern. Wireless messages of distress were flashed, but it was not until 6:30 that the steamer "Pere Marquette No. 17" of the same steamship line was sighted. By this time all the passengers were on deck, fully aware of the desperate plight of the ship. Even then, however, the captain felt he could make the Wisconsin shore, toward which he had directed the ship when he realized there was a probability that she would sink.

Suddenly the ship listed heavily to starboard, the stern started to go down, the bow raised, and the big car ferry disappeared beneath the waves. While she was going down several explosions, caused by the compression of the air in the closed car deck, blew off parts of the upper decks, and killed many







DEVICES USED TO SECURE FREIGHT CARS TO DECK OF CAR FERRIES

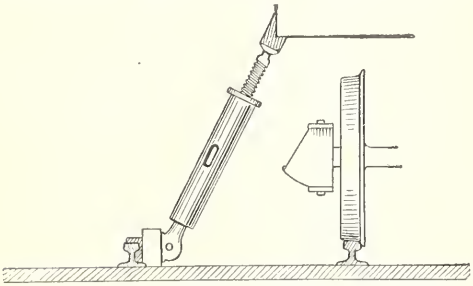
Chain and Turnbuckle Fastened to Floor Hook Between Tracks

Chain and Turnbuckle Fastened to Dog on Extra Track

Iron Jack Fastened to Rail

persons who were struggling in the water. Many of the passengers ran to the bow and jumped into the sea.

The "Pere Marquette No. 18" had been used during the summer as an excursion boat, daily carrying hundreds of the people of Chicago on short lake trips. The trip from Ludington on which she sank was the first of the year as a car ferry. That day the crew had been paid off by the excursion company which had chartered her for the summer; and it has been hinted that some of them had been celebrating.



Brace to Prevent Side Movement of Car Body

The ship was 338 ft. long, had a beam of 56 ft. and a draft of 20 ft. The car deck, provided with four tracks, with a capacity of 30 cars, ran the entire length of the ship, and was open at the stern. While there has been some adverse criticism of this open stern, used by a score of car ferries on the Great Lakes, it has not heretofore been regarded as dangerous. Hereafter, however, these boats will be provided with sea doors, closing up this opening. In December, 1909, the "Marquette and Bessemer No. 2," a car ferry of this type, foundered in a storm on the Great Lakes, and the "Grand Haven," built on the same plans as the "Pere Marquette No. 18," had a narrow escape from foundering during the same winter when, fearing he was too near the shore, the captain attempted to reverse his engines and run his ship backwards. The sea that came through the open

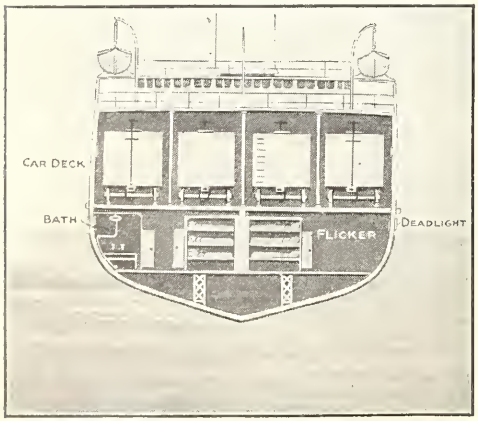
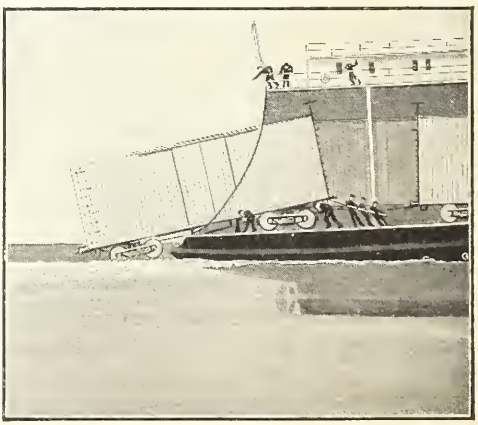


Diagram Showing Arrangement of Cars on Deck, and Flicker Which Crew Occupied



This Drawing Shows How Freight Cars Might Have Caught on "Fantail" at Stern

View of "Pere Marquette No. 18," Taken While She Was Serving as Excursion Boat, Showing Open Stern—Stairways to Lower Deck are Removed in Car-Ferry Service

stern filled the engine room, putting out all the fires with the exception of one, and filled the after compartments with tons of water.

European marine architects have apparently recognized the danger of the open stern, and a car ferry recently built at Newcastle-on-Tyne, for a Swedish railroad company, is provided with sea doors. The officials of the Pere Marquette Railroad, which road operates a large fleet of car ferries, have ordered sea doors placed on the vessel now being built to replace the one which sank.

Every precaution is taken to secure the cars to the deck and avoid what every sailor dreads, shifting of cargo. One of these heavy freight cars could create havoc if it became loose during a storm. There are four principal means of fastening them. Jacks are

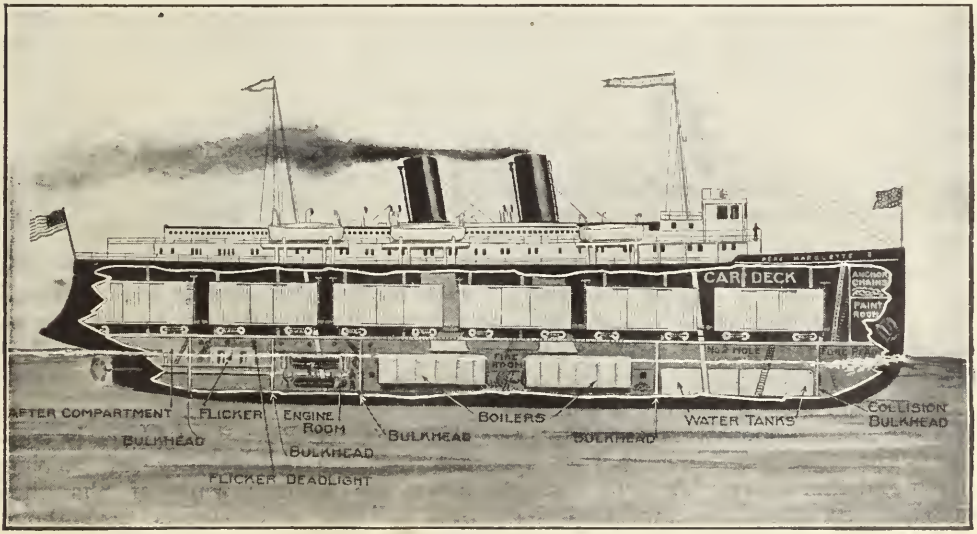


Diagram of Interior Arrangement of Car Deck and Lower Compartments

placed on each side of the wheels, chains and turnbuckles are run from the center of the axles to a floor ring between the tracks, chains and turnbuckles are run from the framework of the trucks to a dog, fastened to an additional rail, placed beside the main rails for that purpose, and a heavy steel brace is placed against the side of the car to prevent its capsizing.

There are as many theories as to the cause of the sinking as there are men engaged in shipping on the Great Lakes. But that open deadlights in the flicker—where the crew slept—were the main cause, seems to be undeniable. These deadlights are only about 20 in. above the waterline, and it was the duty of a watchman to inspect them every half hour.

Following are some of the theories advanced:

That water was shipped through open deadlights in the flicker, filling the lower compartments, and that this condition was not discovered until too late to resort effectively to the pumps.

That the bulkhead between the flicker and the engine room compartment gave way under the pressure of water, permitting the flooding of half the ship.

That one of the 18-in. deck scuttles near the stern might have been washed off by the sea, and the after compartment filled with water.

That water entered through the propeller shaft channels.

That a sea cock was allowed to remain open in the after compartment.

That some of the stern plates were loosened by striking against the slip in which such vessels are backed up to run on the freight cars.

That in an attempt to run freight cars off the deck to lighten the load, some of these cars caught on the "fantail," the added weight pulling down the stern.

When the big car ferry left Ludington she headed southwest for Milwaukee. The wind was blowing from the north and there was a big sea running. It has been stated by survivors that the ship rolled in this sea, and it is very probable that much water was shipped through the deadlights in the flicker with every roll. The crew, as a rule, was quite busy for a few hours after leaving Ludington, and would not be in their bunks in the flicker. In this way, it would be possible to take on enough water to fill the compartment under the flicker and pull the stern down so that the deadlights would be below the waterline. With six deadlights open and the water rushing in under considerable pressure, it would be impossible for the pumps to take care of it as fast as it came in.

Even then, the designers of the ship say the ship could have remained afloat with this compartment full of water. There was water in the engine compartment, so that it is evident that the bulkhead must have given way under the strain. These bulkheads are of ⅜-in. steel.

How the deadlights could have remained open long enough to take in sufficient water to submerge them is one of the mysterious phases of the disaster. A volume of water capable of submerging the deadlights could not be shipped in half an hour. That is the one point which is most inexplicable in view of the fact that one of the strictest rules of these ships is that the deadlights near the waterline be inspected every half hour. It will probably never be explained, for the men who knew went down with the ship in 400 ft. of water. It is but another instance which shows that the human factor can not be eliminated, even when every means of safety and every automatic device ever invented, is used.

¶A train of eight coaches from Chicago on the Pan Handle road attained a speed of 100 miles an hour between Koutz and Logansport, Ind., September 22.

¶The Prince Regent of China is considering the advisability of tearing down the historic walls of Shanghai and building wide streets throughout the old Chinese quarter of the city.

EDITORIAL

SHALL we fortify the Panama canal? seems a silly question, and yet some thin-skinned people profess to believe, at least they express a belief, that this water highway should be a high seas path. The canal will probably cost about four hundred million dollars, and should be as well worth the price as it is worth the doing. In time of peace, its tolls will doubtless be sufficient to make it at least self-supporting. In time of war, the value to the United States of this short cut cannot be estimated. What would one think of a bank containing millions of gold, whose owners would leave it unguarded through the long watches of the night? What of a huge steamship left at dock with no one on board? The right of the United States to erect and maintain suitable fortifications cannot be seriously questioned by the other powers. Undoubtedly they would all prefer to see it without defenses, for the same reason they would like to see every large power except their own devoid of coast defenses and a navy.

No comparison can be made with the Suez canal, which has no territorial rights, and is owned by an alien corporation. We have the same right and owe ourselves the same obligation to fortify the Panama canal that we have to fortify our home harbors and our island possessions.

* * *

THE cause of the sinking of the Pere Marquette car ferry, while not definitely known to any of the survivors is pretty well determined to be from portholes which were open when they should have been closed. These ports were not so very large, only twelve inches in diameter, and only a few in number, but the man whose business it was to see that they were closed when the lake roughened, for some reason failed to do his duty. It doubtless seemed a commonplace thing to go back to that small after compartment and make sure the openings were shut, but the failure to do so cost the watchman's own life and that of thirty others. It is another sad lesson of the importance of fidelity in what are, or appear to be, small things; and yet most of the serious accidents in modern transportation, seem to trace back to apparently trifling neglect. A switch light is poorly trimmed, as the tender thinks to himself, what matters a single lamp among the hundreds of thousands that nightly connect the farthermost parts of the land with a cobweb of ruby lines. And so the story could be extended indefinitely, but the moral always comes to the fore again, that faithful, conscientious performance of duty is as essential in the unknown, humble worker, as in the leader of men or the hero who saves the battle.

* * *

"WHEN is a life perserver not a life preserver?" is a question which interests us all who travel upon boat lines of river, lake or sea, or have friends that journey by water. The condition of the so-called life preservers on the "Slocum" is even yet fresh in mind, although they were never real preservers in the first instance. However, naval experts declare that any cork preserver, however honestly and carefully made, and however effective when new, deteriorates in time, and according to conditions, sooner or later becomes a heavier-than-water affair. The Shipping World in an editorial urges the adoption of hollow metal life preservers which provide greater buoyancy, size for size, and are not impaired by additional coats of paint from year to year. Investigation has shown that the cork preserver absorbs moisture, in time becoming so deteriorated and sodden as to sink as soon as thrown into the water, while to all appearances it is in perfect condition. The metal life preservers on the contrary remain in condition during the life of the ship.

* * *

THESE lines are necessarily written and printed before the aeroplane flight from Chicago to New York has taken place, but by the time this reaches our readers the event will have become an important chapter in the dazzling records of 1910. The several aviators who are already in Chicago, trimming their sails for the longest flight ever attempted in the history of the world, are brimful of enthusiasm, confident of success and impatient for the day to come. In no previous competition has there been such good grounds for confidence, for the past few months and even days have been piling up success on success. The year has not only brought important mechanical improvement, but continued practice has resulted in an experience and skill which has largely increased the common fund of knowledge. Not for one instant has there been

any thought of hesitation on account of dangers known or unknown. The aviation corps, at home and abroad, have never faltered, and when, at all too frequent intervals, one of the enthusiasts has met with death in awful form, several others with equal spirit have volunteered to take his place.

The confident expectation now is that not only will the Chicago-New York flight be made in less than the allotted time, but that more than one contestant will cover the entire distance. With the experience this contest will furnish, the new year will open with extensive efforts, on a large scale, in all parts of the world, which will fill the coming months with events both thrilling and startling.

As a tribute to the increasing safety of the aeroplane, it is interesting to note that an express train would scarcely suffice to accommodate all the passengers who applied to the contestants for the privilege of being carried on the interstate flight.

* * *

HISTORY has been making so rapidly in aviation as to almost bewilder. In no other mechanical art has there ever been as great progress made in the same length of time. The steam engine, the locomotive, steamship, telegraph, telephone, electric light and automobile, each went through a period of considerable length of time between their point of reasonable perfection and that of practical utility. Aviation, like the aeroplane itself, has leapt into significance with startling suddenness.

Perhaps no other one feature as well emphasizes this as the fact that already men who were prominently in the limelight only a few months ago, as the representative airmen, are already falling out of the line of vision of the public eye. Some devote themselves exclusively to constructional work; others fly only to try new machines of their own design; still others have retired after falls which have either crippled them or taken their nerve. Among these well known names are Bleriot, Paulhan, Farman, the Wright brothers, Duray, Gibbs, Rougier, Sommer, Singer and Rawlinson. It has been said that this retirement is largely due to the intense nerve strain of flying which in a short time so wrecks the strongest nerves as to render a man unfit to go aloft under conditions requiring an absolute control of himself and instantaneous action in emergencies. Perhaps this has been more true in the past than it will be in the near future, as the mechanism of the aeroplane becomes perfected and possibly some automatic device is secured, leaving much less to the decision and skill of the airman.

Mr. Graham-White writing of this feature in the London Daily Mail says:

"It is the tension of fearing that something unexpected may happen—that the engine may fail, that a stay may break, that a controlling wire may snap. Any one of these things may, one knows quite well, bring about a fearful fall. The rush of air, and the fact that one is high above the ground, has very little to do with the ordeal."

And yet another champion of the air, commenting on this, predicts:

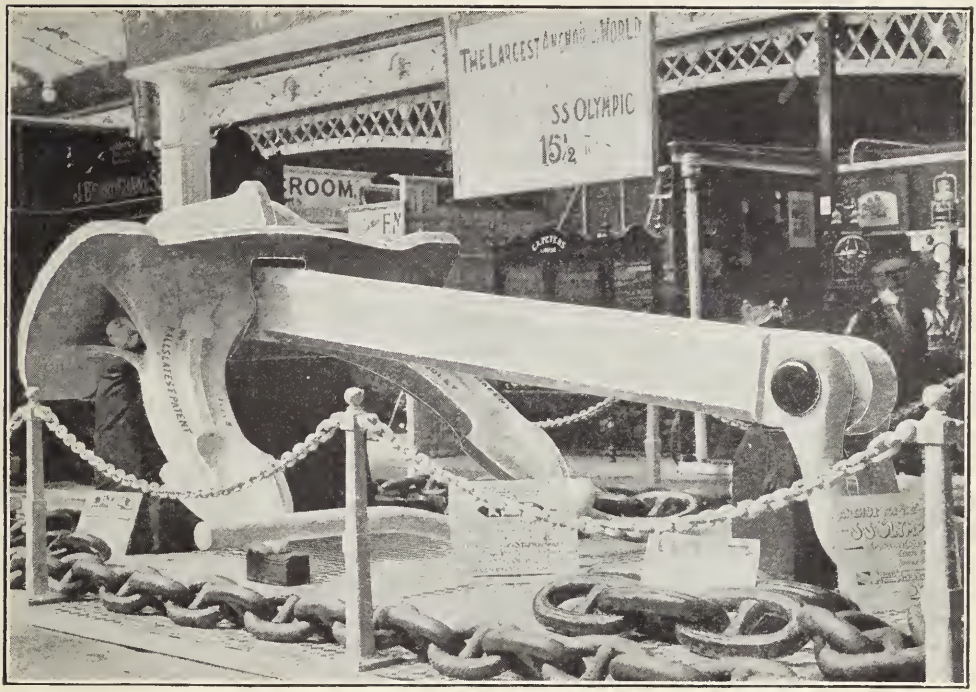
"Experience already proves that flying will become far more easy; aeroplanes are on the eve of enormous development so far as reliability is concerned."

H. H. WINDSOR.

RESULTS OF FRENCH ANTARCTIC EXPEDITION

The achievements of the French Antarctic expedition, under Dr. Charcot, of which illustrations were published in a recent issue, include careful surveys of the previously little known coasts of Graham's Land and Loubet's Land, the discovery that Adelaide Island is 90 miles long instead of only seven, and the finding of new groups of islands. The newly found islands are south of Loubet's Land, and extend into the unsurmountable bank-ice.

Near the island named after Peter the First was found a very deep basin, at one point of which no bottom was reached. The soundings gave depths ranging from 9,090 ft. to 13,050 ft.



One of the "Olympic's" Anchors

LARGEST ANCHOR IN THE WORLD

One of the most interesting exhibits at the recent Engineering and Machinery Exhibition at Olympia, London, was this huge anchor for the "Olympic." It weighs 15½ tons and is the largest in the world, and for the largest ocean liner. The chain for this anchor is said to weigh 100 tons.

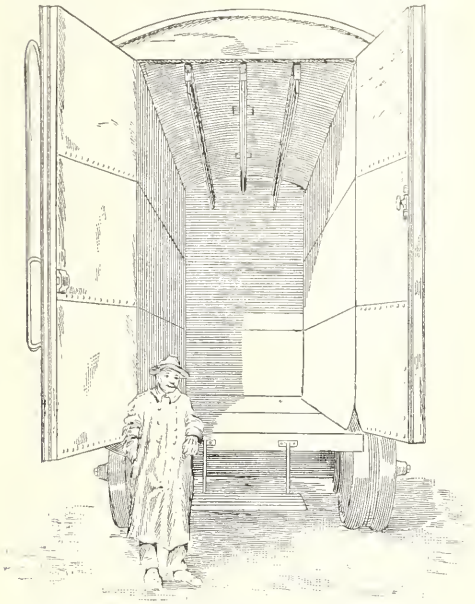
BURNING TUG ABANDONED AND SENT TO SEA

The graveyard of the ocean holds the blackened bones of the tugboat "Lillian Moir," which was sent to sea out of New York harbor under her own steam, her hull and upper works blazing fiercely with a fire her crew tried in vain to quench before they were forced to abandon her. The fire was discovered on the tug at ten o'clock at night as she was putting in at Coney Island Creek for a tow. Unwilling to run the risk of setting fire to the numerous small boats and yachts in the creek and the surrounding harbor, her captain and crew of four men headed the tug out to sea and attempted to put out the fire. Their efforts were vain, however, and so the wheel was lashed to keep her headed out to sea and the tug was abandoned. Searchlights from Fort Wadsworth and Fort Hamilton were kept playing on the vessel as long as she remained within range of the lights. For an hour and a half the people along the Long Island shore were treated to the unique spectacle of a blazing boat of fire steaming out to sea without a soul on board.

¶Reports for May, June, July and August show that 385,083 persons traveled from the United States to Europe during the season of 1910.

REFRIGERATION MOTOR-TRUCKS

The necessity of protecting meat against the influence of heat, even on



View of Interior of Refrigerating Motor-Truck

the relatively short trip between the packing plant and the refrigeration plants on board the ships, has caused a packing firm of the Argentine Republic to install a service of refrigeration motor trucks, which have double walls of metal lined with substantial sheets of compressed cork. Transported in this manner, the meat arrives on board ship in an absolutely sound condition.

REMARKABLE HYDRO-ELECTRIC PLANT IN ARIZONA

A hydro-electric power plant, remarkable for the source of its water supply and the engineering work necessary to utilize it, is located in Hegila County, Arizona. The source of power is water flowing from subterranean springs of unknown depth. The water is so heavily mineralized, that the deposit from it suggested the name Fossil Springs to the discoverer.

The springs yield a flow of 43 cu. ft. per second, which, barring changes by one of the rare rainfalls of the region, has remained absolutely constant from year to year. The flow of water has a possible head of 1,600 ft., but in the present development all of this has not been utilized, as by employing only the lower 1,100 ft. as a fall, it is possible to use a basin of 28 acres as a storage reservoir.

To get the water from the head works to the power house requires 38,000 ft. of conduit, of which 12,000 ft. is of reinforced concrete flume, 10,000 ft. of concrete tunnels, 7,500 ft. of steel gravity syphon, 2,200 ft. of wooden flume on trestles, and the remainder concrete and steel piping.

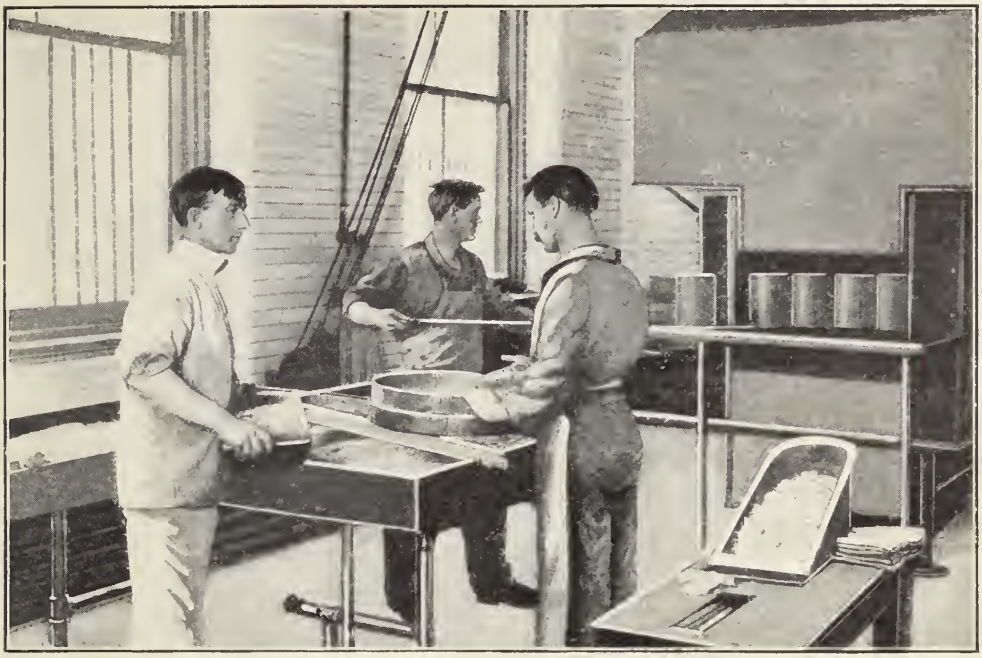
The power house contains three 18,000-kw. generating units with equipment for a line voltage of 45,000, which is carried over 75 miles of steel-tower transmission line. The energy is delivered to Prescott, Arizona, and to the important mining district about 60 miles distant.

TIN MAN AS WALKING ADVERTISEMENT

A hardware dealer in Clintonville, Wis., recently built a giant tin man of materials on sale in his store, hired a man to walk the streets inside of it, and as a result drew much attention to his wares.

A Man of Tin

The giant of tin was 8 ft. 4 in. in height; its head was a 12-in. ball, made of 19 pieces of galvanized iron, with a nutmeg grater for a nose, and tin scoops as ears. The teeth and tongue were plaster of paris, the



"Pickling" Room of the Canadian Mint at Ottawa

eyes of artificial glass, and the hat of Russian iron. A 6-in. tee joint with elbows formed the shoulders, the arms were made of taper joints, and the body was composed of two pieces of galvanized iron, with buttons made of tins taken from teakettle knobs and soldered into rivet heads. The collar was bright tin, the necktie copper, and the vest a piece of galvanized screen covered with cheesecloth. The head of the man inside rested against a thick pad riveted onto the tee joint, and he looked his way through the screen used for the vest. The shirt was a hopper of common stove-pipe iron, the legs were formed of roofing tin shaped as a grain spout, and the foot covering consisted of old shoes covered with aluminum bronze and iron buckles.

"PICKLING" COINS WITH ACID

Few people are aware that all coins that come from a mint must be "pickled." The "pickling" follows an annealing process, which hardens the metal, and removes the copper oxide which the intense heat of the furnaces has caused to form on the surfaces of the blank metal disks. The "pickling" is done with sulphuric acid and the coins are allowed to remain in the bath but a moment. When they are removed, they are dried in sawdust and then passed on to the die machines which stamp the figures on the two sides.

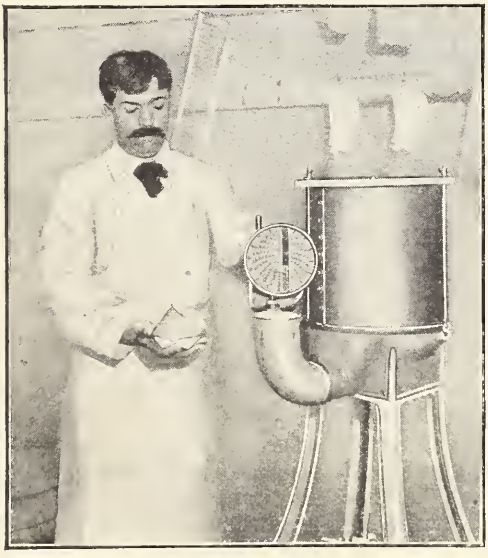
GREAT COALING STATION FOR PUGET SOUND

If Congress makes the necessary appropriations, the Navy Department will construct a 200,000-ton coaling station at the Puget Sound navy yard. Preliminary surveys have been made for a fuel station for the Pacific fleet. A sufficient supply of coal will be kept on hand at all times to meet any demand which might arise during a war.

When the coal mines of Alaska are opened, the supply of coal for naval purposes on the Pacific will come from them. The department has also reserved a site for a coaling station on Resurrection Bay, near Seward, Alaska.

LARD-SELLING MACHINE INSURES ACCURACY

Housewives will welcome the introduction of a device for selling lard which is so constructed that it gives the exact weight called for. This novel machine has just been invented and the weighing mechanism is controlled by the dial to weigh from one ounce to several pounds. A 5-gal. receptacle holds the supply of lard which is forced down into the pipe that is turned upward and has the dial at the upper end. The operator has just swung the upper section of the pipe around to the back

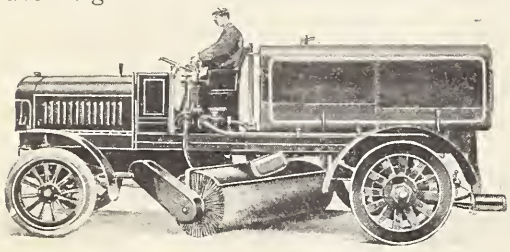


Automatic Scales Gives Customer Exact Amount of Lard Ordered

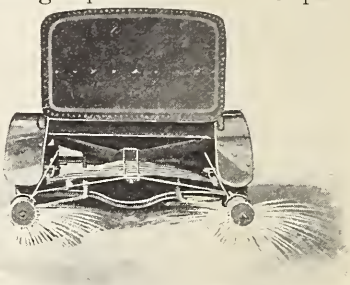
to extract the lard measured out therein. The lard surface can be seen in the open pipe.

GERMAN COMBINATION MOTOR SWEEPER AND SPRINKLER

Several German cities are now using a motor-propelled combination sweeper and sprinkler which allows the two street-cleaning operations to be performed either simultaneously or successively.



Side View of Combined Sweeper and Sprinkler



Rear View with Sprinkling Heads

Such a type of street-cleaner is of special value for small communities, as it enables one man, operating this single vehicle, to clean all the streets in the morning, and sprinkle them in the afternoon. On much-used city thoroughfares, the simultaneous sprinkling and sweeping with one vehicle is a great improvement over any method in which two vehicles must be utilized.

The machine develops 25 hp. The gear operating the revolving brush and the centrifugal pump for spraying is mounted on a longitudinal shaft.

EXTRAORDINARY GRADIENTS ON BRAZILIAN RAILWAY

The steepest gradients of any railway built with ordinary rails are found in Brazil on the road joining the bay of Rio de Janeiro with Nova Friburgo, where grades of 92 in 1,000 are encountered. It requires a three-truck locomotive, weighing 40 tons, all the wheels of which are drive-wheels, to draw a train over this bit of track at the rate of 10 miles an hour. During the descent of such grades the brakes are used, and for the steepest places the locomotives are equipped with special brakes that act on an auxiliary rail set between the regular rails.

ELIMINATING THE GLARE IN SPECTACULAR ILLUMINATION

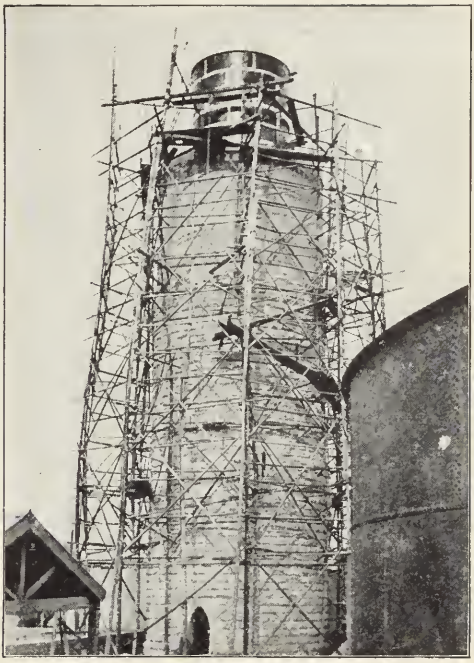
The softening of light used in spectacular exterior illumination is becoming quite general throughout the world, and the use of the glow lamp instead of the incandescent bulb is increasing. Authorities on the subject have come to the conclusion that the new system gives a softer light to the building or device to be illuminated, thereby bringing out the finer lines and artistic features in a better manner than the blinding glare of the incandescent. Only white buildings or signs, or structures of such color as will reflect light well, have been used for this purpose.

One of the best examples of the new system was found at the ill-fated Brussells Exposition where the engineers used 3,500 lamps of varying power to emphasize the graceful architecture of one of the white buildings. The use of lamps of different candlepower to bring out the lights and shadows, if such it may be termed, was highly successful in this instance. Seven hundred 50-candlepower and 800 25-candlepower glow lamps, all concealed, were used for the brighter portions of the scheme, while 2,000 two-candlepower lights were employed for outlining particular features of the architect's plans. The contrast between the relatively dark roof and gables and the brighter walls was striking and received much favorable comment. This method is being employed quite generally throughout the United States for advertising purposes.

CHINESE SCAFFOLDS MADE WITHOUT PLATFORMS

The scaffolding in this illustration is erected around the standpipe at Tientsin, China. There are no nails or bolts used in its construction, the bamboo poles being bound together with ropes. The workmen do their task while standing on the bare poles, no platforms or planks being provided as in America.

The standpipe is rather curious, as



Chinese Scaffolding

it is composed of stone, concrete and steel, each of which materials forms a separate section. The construction is stone masonry about two-thirds the distance to the top. Above this is a concrete section, on top of which rises a steel tank. The structure is 100 ft. high, and has a capacity of 20,000 imperial gallons. The imperial or British gallon contains 56 cu. in. more than the standard gallon in use in America.

IRON ORE RESOURCES OF THE WORLD

The report of the International Geological Congress on iron ore gives the total amount of the actual known reserve of the world as 22,408,000,000 tons, of which 12,032,000,000 is in Europe, 9,855,000,000 in America, 260,000,000 in Asia, 136,000,000 in Australia, and 125,000,000 in Africa. Of the 22,408,000,000 tons of iron ore, the proportion of iron is 10,192,000,000 tons, of which 5,154,000,000, or more than half, is available from the 9,855,000,000 tons of iron ore in America.

EXPANSION OF WATER IN FREEZING

The expansion of water in freezing is remarkably demonstrated in this illustration. The neck of the ink bottle is about 1¾ in. long, and the top of the cork is about 3 in. higher on its neck of ice. The bottle burst a few moments after the photograph was taken.

¶A Trinidad sugar planter is said to be making paper from sugar cane stalks with such excellent results that it will pay to grow cane for paper alone, and make sugar as a by-product.

MOTOR TRICYCLES CARRY MAXIM GUNS

Motorcycles of both the two and the three-wheeled type took prominent parts in the recent maneuvres of the British territorial army, which corresponds to the national militia in this country. Among the most interesting machines were two motor tricycles, each fitted with a special platform on which a Maxim gun and its tripod were carried.

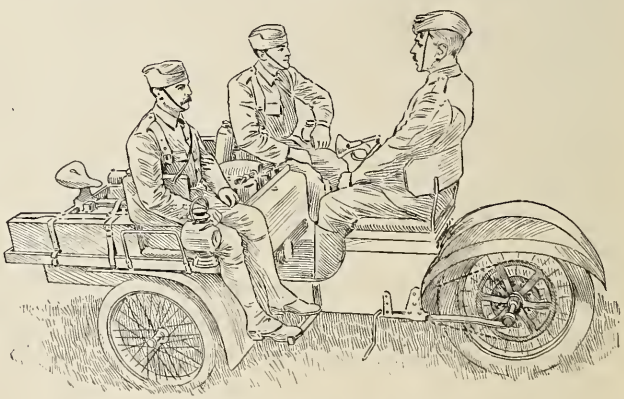
In addition to the gun, each machine carries three gunners, of whom one, facing forward, operates the machine, while the two others, facing backward, occupy small seats, one on each side of the platform. The gun is kept in place by a raw-hide thong and one pull of this is sufficient to disengage it from the platform. Thus, when the firing position is reached, the gun can be quickly set up.

POWER STATION USES GAS AND OIL FUEL

Natural gas, with oil as an auxiliary in case of low pressure or accident to the gas supply lines, is the means of generating heat adopted by the electric light and traction company at Fort Smith, Ark. The natural gas has proved itself thoroughly dependable as a working fuel, and the oil supply is called on only at times of heavy commercial gas consumption, when the operation of the plant burners seems likely to affect the distribution pressure.

NEW SELF-COOLING GUN

Tests are being made by a Toledo, O., company, of a new self-cooling gun, built on the machine gun principle, which, it is claimed, is so arranged that the life of its barrel is extended from the limited period of the ordinary uncooled weapon to an indefinite number of years. As many as 500 shots have been fired from the gun without materially raising the temperature of the barrel. The device consists of an outer metal jacket fitted over the barrel of an ordinary service rifle, into which a cooling liquid is pumped from a barrel or tank. The turning of the crank that operates the firing mechanism also works the pump. The gun is mounted on wheels and weighs 300 lb.



For Rapid Transportation of Maxim Guns

THE SOUTH CHICAGO STEEL MILLS AT NIGHT.—The Glare of the Furnaces and Bessemer Converters Turn Night into Day, and Thousands of Men Reverse Nature's Program to Appease the Insatiable Appetite of Progress for Steel.

WHERE MEN MAKE MOUNTAINS OF ORE INTO MILES OF RAIL

By WILLIAM F. WILLARD

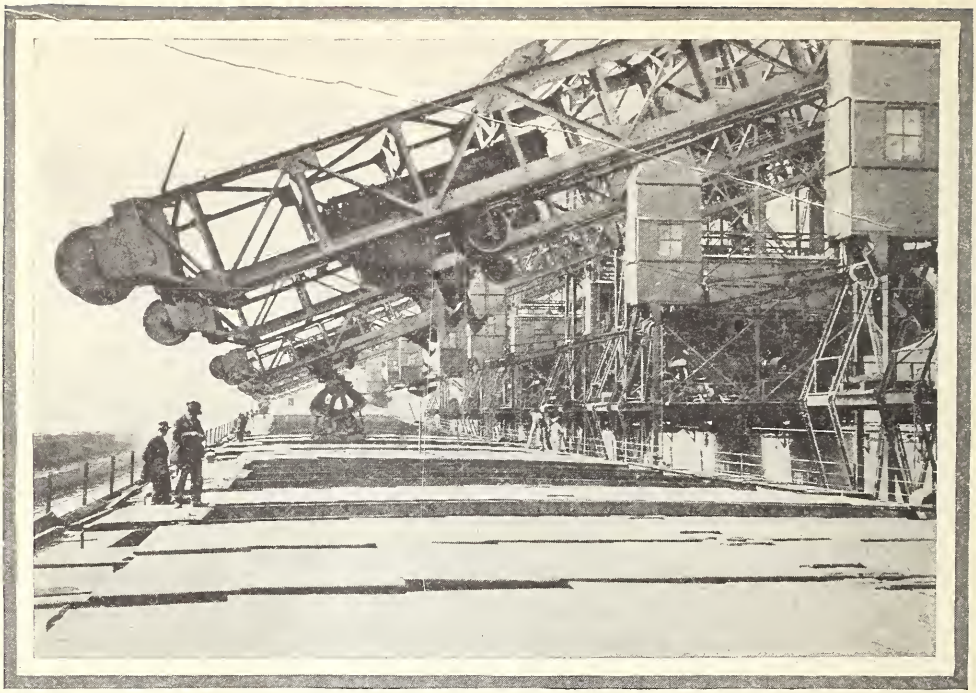
CAPTAIN John Smith, of Jamestown, Va., was somewhat of an ironmaker in his day. True, he had no Carnegie, Gary, Schwab or Frick on his board of directors, but, considering this disadvantage, he did pretty well. When the doughty captain and his sturdy band of Englishmen settled down to live a life of simplicity at the town on the James River which they had named after their sovereign, their supply of plowshares, guns, tools, and other agricultural and domestic implements ran low, and, in true pioneer fashion, they began to consider the possibility of establishing a little iron trust all their very own.

Diligent experiments resulted in the setting up of a very modest iron furnace, and by dint of labor and perseverance, a few pounds of real iron was produced and wrought into useful articles.

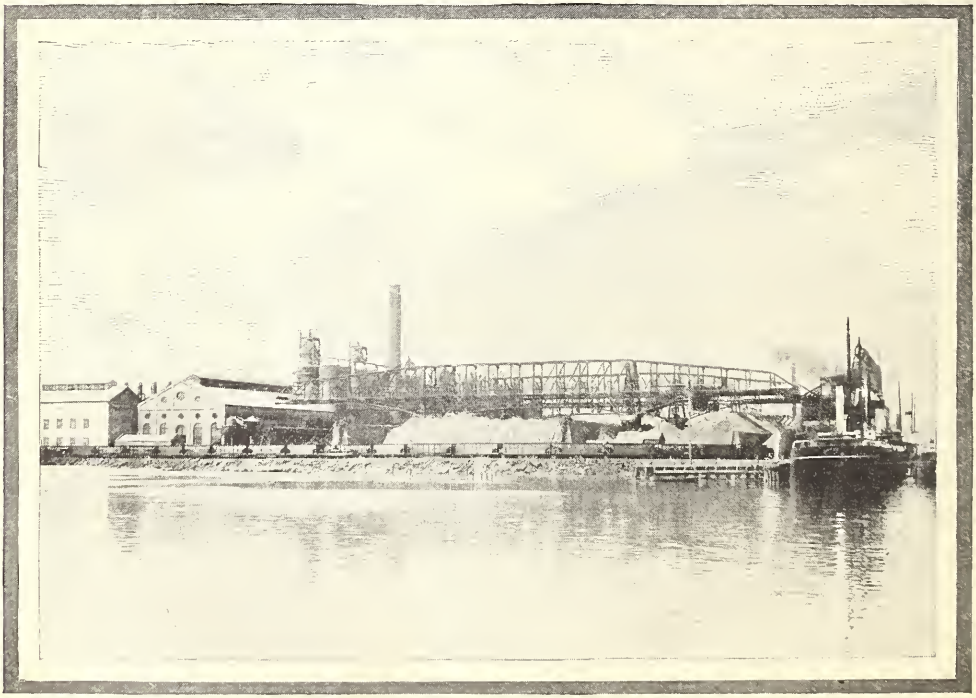
That the Jamestown iron industry did not result in the establishment of many libraries was not the fault of Captain Smith. It was in 1622, three years after the furnace had begun to do business, that the hostile Indians visited the settlement and proceeded to kill, burn and demolish. They did not overlook the iron industry.

It is probably safe to say that if the shades of the Captain and his ironworkers could visit some of our great steel mills today, they would be very much surprised. They would see an ingot of fiery red steel, manipulated by giant hands, made into a steel rail in a few minutes, and they would also see ponderous rollers shape a billet into sheets of metal in an equally short time.

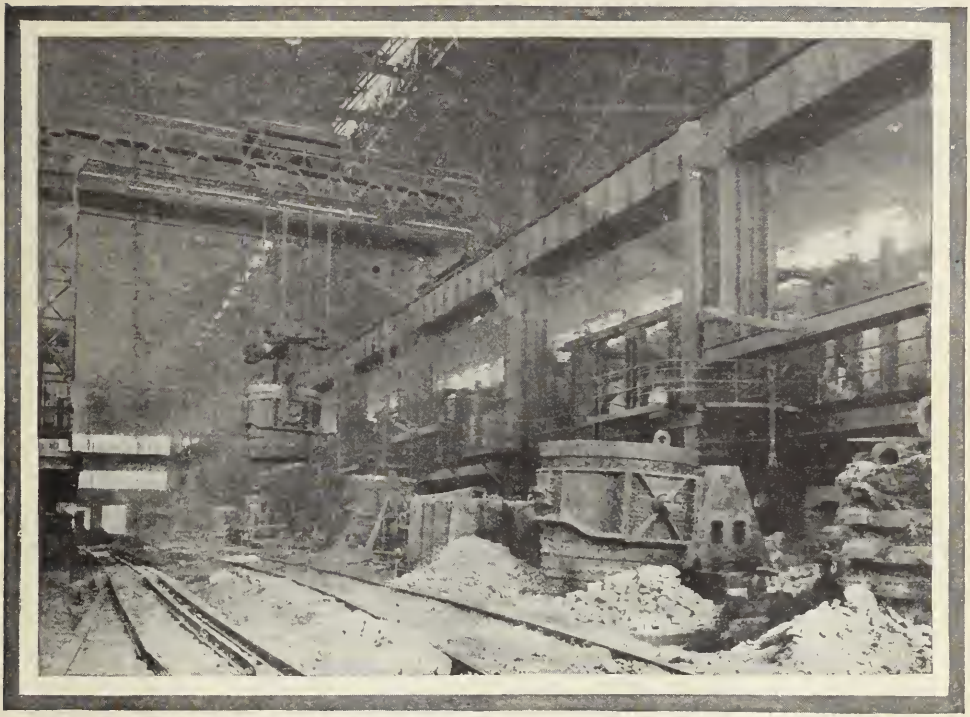
The most impressive thing about our great steel mills is the apparent simplicity of their methods. Yet this has been reached only by years of work and study, and, it must be said, at the cost of hundreds of lives.



ORE UNLOADING MACHINES.—With these unloading machines a boat holding 12,000 tons of ore can be discharged in 4½ hours. Some of the boats have 36 hatches. The "clamshell" buckets, shown on the fourth boom, seize seven tons of ore at a time and carry it 50 ft. to the ore trough, the entire operation being performed in one minute.



DOCK, ORE YARD AND BLAST FURNACES.—This view shows the complete method of handling ore from boat to blast furnaces. A 15-ton glab, traveling on the 525-ft. bridges, distributes ore in the yard, according to its chemical composition. This dock, on Calumet Lake, is 1,700 ft. long, 600 ft. wide, and has a capacity of 1,250,000 tons of ore.



BATTERY OF FURNACES IN OPEN-HEARTH PLANT.—A terrific heat is created in these furnaces by currents of air fired alternately from one chamber to another. The furnaces are tapped and metal allowed to run into immense ladles, such as is seen in the middle of the pit. From this it is poured into moulds.

It was not so very many years ago that Pennsylvania was the source of all of our steel. Now, great steel mills are operated in all sections of the country, north, south, east and west. With the great deposits of the Lake Superior region at their doors, the mills of the United States Steel Corporation at South Chicago and Gary are working day and night. At Birmingham, Ala., other mills are transforming the ore of the surrounding mountains into rails and structural steel, while out at Irondale, Washington, a new era in the industries of the Pacific Coast was opened a few months ago when the plant of the Western Steel Corporation began to turn out ingots.

The Gary plant, around which a city was built, is destined, it is said, to be the greatest steel producer in the world, not excepting the Krupp works of Germany, which employ 68,985 people. But the plant of the Illinois Steel Company at South Chicago is keeping pace, and is clinging tenaciously to its reputation as the largest mills in the United States. When the plans for the Gary plant are completed, however, the Illinois company will have to take second place, in the amount of production, at least.

The blast furnaces at the South Chicago plant never sleep unless they become indisposed. They are eleven in number and at night, for miles around, the reflection against the sky resembles sheet lightning. The principal blast furnace is the largest stack, and it is here that the ore is charged and smelted, and from this the molten metal is taken. Here rivers of iron are as common as water.

There are two processes of making steel. Each requires the hot liquid metal from the blast furnaces. In the Bessemer process, the hot metal is conveyed to the mixers, where it is re-

tained until ready to be sent to the converters. Besides the virgin iron, ferromanganese (spiegel) and steel scrap is afterwards added to the hot metal to improve the fiber and quality of steel in carbon, the grade of steel depending upon the amount of carbon it contains.

OPEN-HEARTH INGOTS.—After metal has been sufficiently cooled, the mould is lifted by the "grip" seen on the left. The mould is provided with lugs on the sides, and the hooks of the grip engage these lugs. When the grip is lifted, the plunger, seen in the center of the grip, rams the ingot down.

The metal is now sent to the converters, which are large vessels lined with fire clay. Here a strong blast of air is forced through the molten pig-iron, producing a rapid destruction of the impurities of the metal. The amount of heat resultant from this oxidation or combustion is so great that it is more than sufficient to maintain the bath of the iron liquid even after practically the whole of the carbon has been burned and the melting-point greatly raised. The process carried on in the converters is a very beautiful and impressive sight. It reminds one of the pictures in Dante's "Inferno" of the bottomless pit canopied in pyrotechnic splendor, or the scenes so vividly described in "The Last Days of Pompeii."

The molten metal in the Bessemer converter requires about ten minutes of the blast, whereupon the vessel is ro-

tated into a horizontal position and the metal poured into ladles. These ladles are handled by mammoth hydraulic cranes which work as though endowed with human intelligence. Every operator here must have perfect control of his machine to protect the lives of his fellow workmen. Imagine a huge crane supporting a caldron of hissing, seething tons of molten metal near your head! And then the tap-hole must be opened by hand! Should only a half pint, or even less, of the liquid touch the clothing, or hand, the result would be disastrous to the workman.

When the tap is open the metal runs into pyramidal forms mounted upon trucks. These forms are molds for ingots. When cool enough, a machine called a "stripper" lifts off the mold, and the ingot, 18 by 20 by 56 in., still hot, is sent to the rolling-mill to be rolled into steel rails. Before the rolling process takes place, the ingots are "soaked;" that is, they are reheated to an incandescent heat, and then hoisted by cranes upon the "runs" which carry them back and forth through monstrous blooming-rolls.

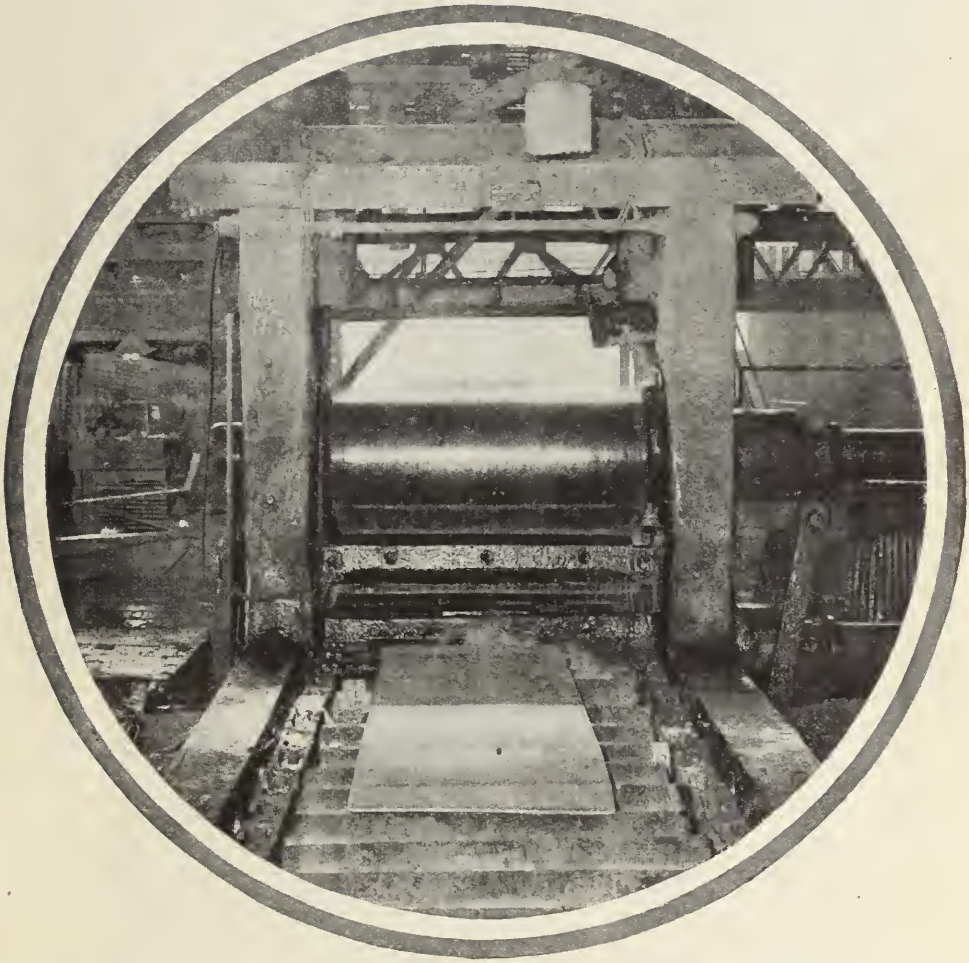
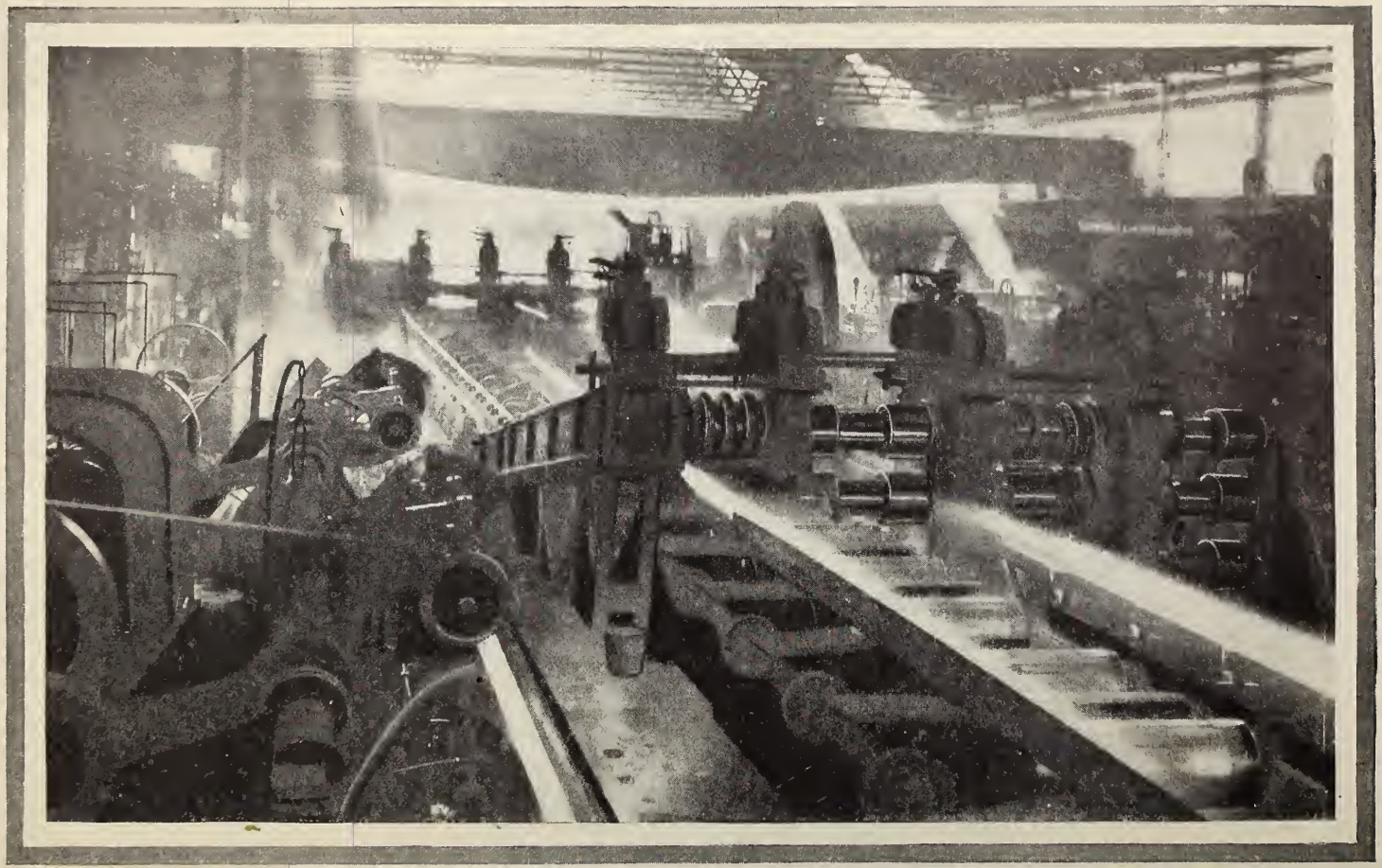
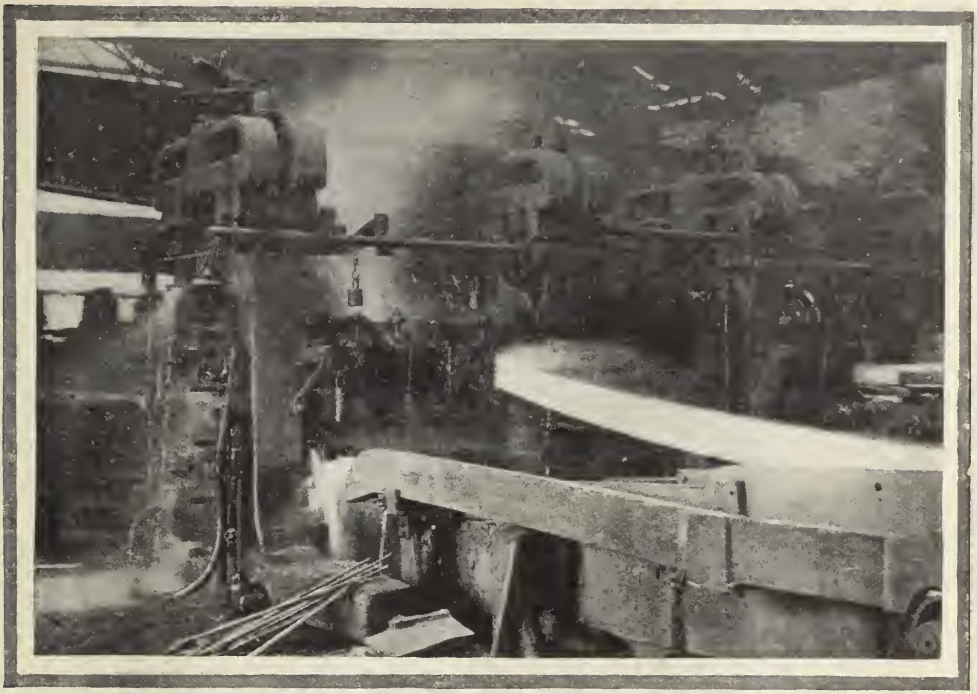


PLATE MILL ROLLS.—A slab of steel, heated to incandescence, is passed back and forth between the rolls until reduced to a plate of the desired thickness in the same manner that pie crust is rolled. There are three rolls and each weighs from eight to ten tons.

The product of each converter is



GENERAL VIEW OF THE RAIL MILL.—Three minutes after an ingot is placed in this mill it has assumed the shape of a rail, and is cut to the proper length by the circular saw seen at the left. It passes through 18 rolls before it is sawed off, each approaching nearer the shape of the rail. The strip of metal is passed automatically from roll to roll, requiring no attention. Leaving the mill, the rail is cooled and straightened, drilled for fish plates, and is ready for shipment.



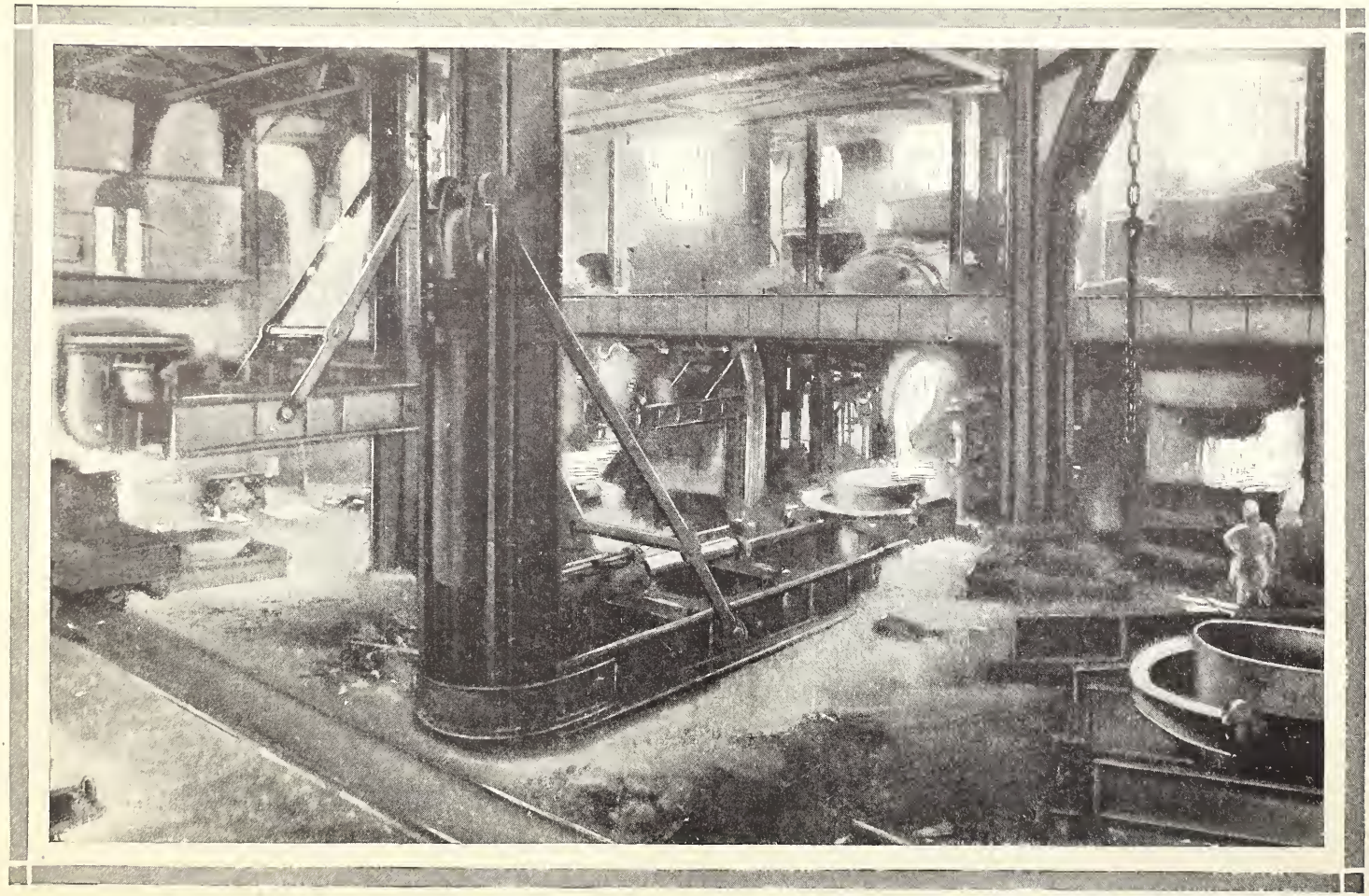
THE FINISHING ROLLS AT THE RAIL MILL.—The ingot is passed through rolls, successively smaller, the openings of which gradually approach the shape of a perfect rail, until, after 18 such "passes," it evolves as a long bar, which is cut into 30-ft. rails.

tested and analyzed by chemists in well equipped laboratories at the plant. Each order specifies the proportion of carbon, sulphur, manganese and silicon required, and the tests must bear out the specifications of the engineers. As a record is kept of these tests, any complication or accident arising even in years after can be traced back to the order and to the chemical analysis made at the time of purchase. The larger railroad companies also employ experts who make tests unbeknown to the manufacturers and not in cooperation with them. In the physical laboratory the metal is tested again for tensile, torsion and compression strength.

The Bessemer process dates from 1856 and was named after its inventor, Sir Henry Bessemer, an Englishman, who was born in 1813 and died in 1898. Of his numerous contributions to science, the manufacture of steel crowned him with fame. While the process has been improved considerably, no material changes have been made in his method, although of late years, considerable prejudice has been manifested against the Bessemer process. Experts favoring the open-hearth process have blamed Bessemer rails for some railroad wrecks, but it is an open question, on which authorities are at variance.

There are two open-hearth furnaces here. In these, also, the melted ore from the blast furnaces becomes the base of the product. Limestone, silicon and ferro-manganese are added as before, but the gases have an easier opportunity to escape from the furnace, and hence the air blast is not necessary. Scrap iron is added to the liquid mixture, and this is done by means of a crane. Every addition to the hot metal is weighed and recorded.

The principle of the open hearth is to develop a heat far above that of any ordinary coal or gas furnace. The hearth of this furnace has a bottom of magnesite about 8 ft. deep. Upon this bottom lies the lake of molten metal.



A COMPREHENSIVE PHOTOGRAPH OF THE BESSEMER PROCESS.—This is said by steel experts to be one of the best photographs of the Bessemer process ever taken. Three converters are seen in the background. A blast of air is forced up through the molten metal for about 12 minutes, to remove impurities. It is then refined steel. The converter is then tilted and discharges its contents into an intermediate ladle, which in turn dumps its contents into the pouring ladle. This secures a more homogeneous composition. The pouring ladle is then picked up and swung around by the huge crane seen at the left of the illustration, and is poured into hollow iron moulds, carried on small trucks.

Magnesite is found to best withstand the terrific heat and the disposition of the metal to burrow. Brick of magnesite are also used about the furnace. After the charge has been placed, currents of air and gas are fired alternately across from one chamber to the other, creating a terrific heat. This burns out all of the impurities, whereupon ferromanganese, an imported product from Austria, is added as described above. Manganese supplies the necessary percentage of carbon. Limestone helps to remove the phosphorus by forming a slag which is capable of absorbing phosphorus. It also assists in preventing the destruction of the lining of the furnace.

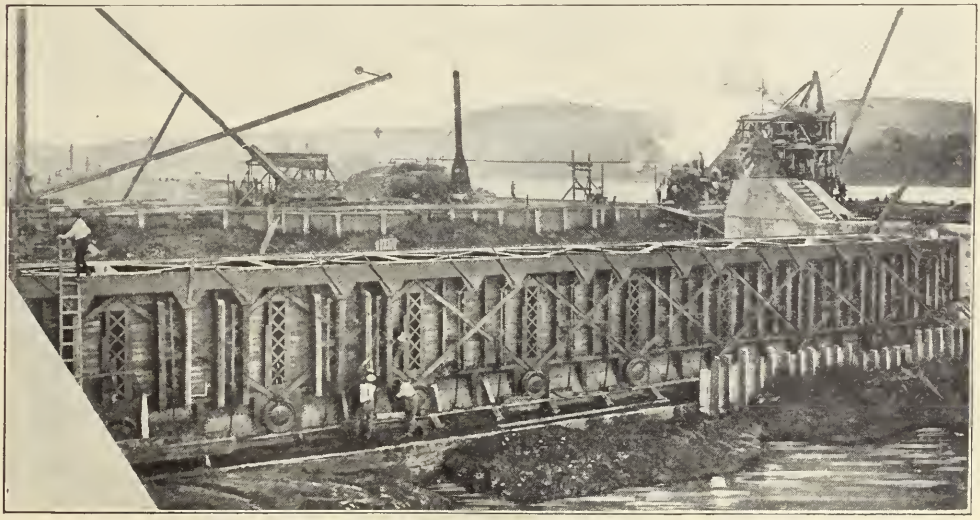
All the pouring is done in the pit, into molds, as in the Bessemer process. The molds are mounted on trucks and taken to the stripper by a locomotive. The ingots are then sent to the blooming-mills, where they are either rolled into billets, Z-bars, I-beams, or slabs. Billets come from the blooming-mills; bars, channels, angles and beams from the structural mills, and slabs from the slab or plate mill. The general operation of these mills is the same. Each mill has its own power furnished by modern high-power machinery. Electricity is supplied from one central power-house, and water from a central pumping station. Large electric or hydraulic cranes handle most of the work.

LARGEST MOVABLE-WICKET CONCRETE DAM IN WORLD

The government concrete lock and dam in the Ohio River at Fernbank, Ohio, about 12 miles down stream from Cincinnati, said to be the largest concrete movable-wicket dam in the world, is now ready for operation. The cost of the work was $1,050,000, and the period of construction six years.

The dam, which is officially known as No. 37, was constructed by the government as a step in making the Ohio River navigable all the year around from Pittsburg, at its source, to Cairo, where it flows into the Mississippi. It gives Cincinnati a permanent river depth of 9 ft., and for a distance of 50 miles up, the stream will always be navigable, no matter how low the water is elsewhere in the river.

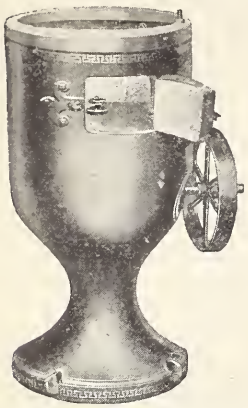
In addition to this big dam at Fernbank, the government is building or will soon build 36 smaller dams between it and Pittsburg. Several near Pittsburg have already been completed.



Movable Wicket Dam near Cincinnati

CONCRETE POTATO-PEELING MACHINE

A potato-peeling machine of concrete, the rough interior surface of which constitutes the peeler, is being manufactured by a Chicago concern. The machine is an urn-shaped vessel with a revolving disk in the bottom of the bowl. This disk is driven from below, through bevel gearing, at a speed of 600 revolutions per minute, and spins the potatoes around the inside of the bowl. The rough surfaces of the disk and bowl rub off the skins, and several sprays of water, injected at the upper edge, wash the potatoes clean and carry the refuse out at the bottom.



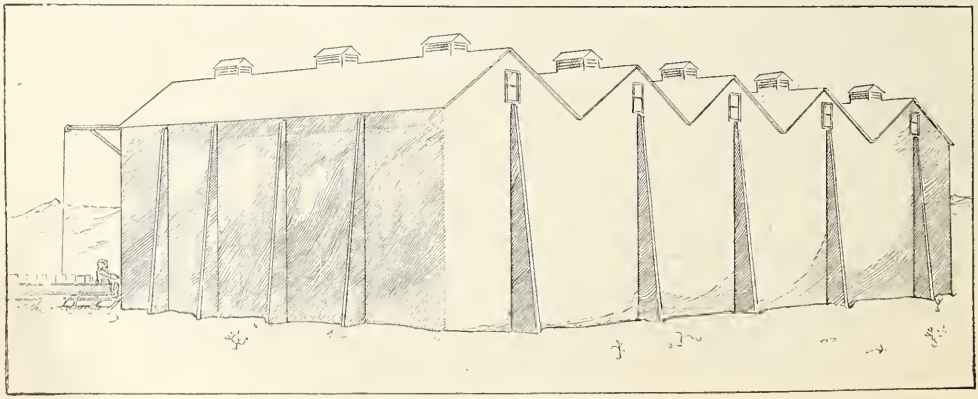
The peeled potatoes are removed and a new batch put in without stopping the machine. A door in the side of the bowl is opened at the proper time and the potatoes are ejected by centrifugal force into a galvanized iron receptacle. A ½-hp. motor furnishes the power, and it is claimed the potatoes are peeled in two minutes. The machines are manufactured in ½-peck, peck, and 2-peck sizes, the former for use in the small restaurant, and the latter for large restaurants and hotels. The machine with a capacity of a peck stands 3½ ft. high.

CONCRETE ICE HOUSES

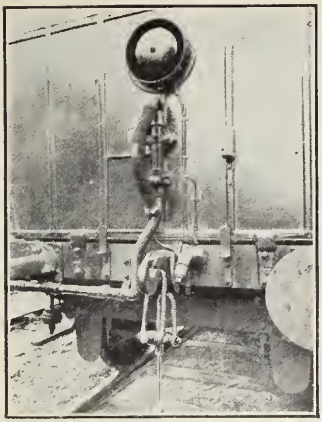
Under ordinary conditions, the cost of construction of concrete ice houses is so much greater than of such structures made of wood that even the saving of insurance, the expense of repairs, etc., would not bring it down to a reasonable figure. The estimates made by contractors in different parts of the country show that the cost is from 25 to 35 per cent higher than for wood, but the plant here illustrated was erected at a cost of 20 per cent less than would have been necessary had wood been used.

The conditions under which it was constructed, however, were out of the ordinary. In the first place, a large sand and gravel bank, within 100 ft. of the building, furnished all the material except the cement, the only expense being in moving it the few feet to the concrete mixer. Secondly, no architects, contractors, or supervising engineers were employed, the company having men of sufficient experience, skill, and ingenuity to do the work, although none of them had ever used concrete before.

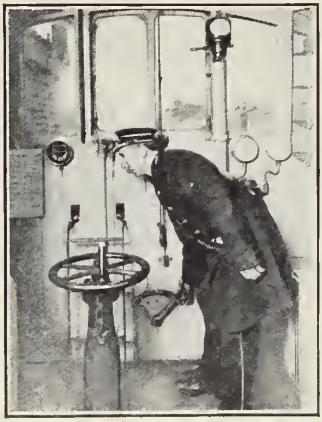
The method of construction, with the side and rear wall wing braces, can be seen in the illustration.



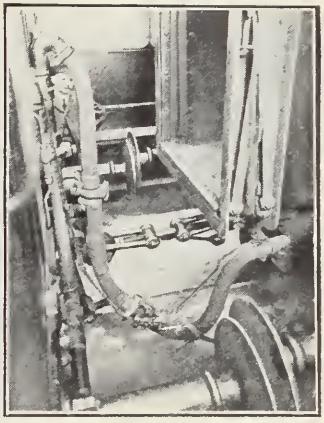
Concrete Ice House at Monroe, N. Y.



Front View of Slip-Coach Mechanism. Above the Break Pipe is the Electric Gong which Sounds Immediately the Coach Parts.



The Guard First of all Pulls over Lever Which Closes Vacuum Break Valve and Sets Pneumatic Slip Apparatus.



The Ingenious Vacuum Break Coupling.—Vacuum-Break Air Hose, Connected Up, and Rope Which Breaks Hose Coupling.

DROPPING PASSENGER COACHES ON THE RUN

The ingenious means by which one of the great railroad systems of England drops passenger coaches off at intermediate stations without slowing up the locomotive, even for a fraction of a second, in its speed of 60 or more miles an hour, is called the "slip-coach" system. It is a system never tried in America, and consists in dropping, or "slipping," one or more of the rear coaches just before the station is reached. Undoubtedly many American tourists traveling in England, after alighting at their destination, have been amazed to discover that the coach which they occupied was still beside them, while the locomotive and remainder of the train were nowhere to be seen.

The slip coaches are provided with special coupling and breaking mechanisms which are shown in the illustrations. One of the most ingenious of these mechanisms is the vacuum break coupling, by means of which it is possible for the engineer of the train to apply the air brake on the slip coach as well as on the train until a few seconds before the former is slipped. Some distance away from the station, the guard pulls a lever which closes the vacuum break valve and sets the pneumatic slip apparatus. Then he pulls a cord to disconnect the vacuum break coupling, and raises a valve, which causes the hinged portion of the draw-bar hook to drop and the coupling section of the coach in front to fall away. This completes the disconnection, and the main portion of the train, running at full speed, gradually draws away, while the guard manipulates his brakes to bring the slip coach to a stop at the station, judging the distance.

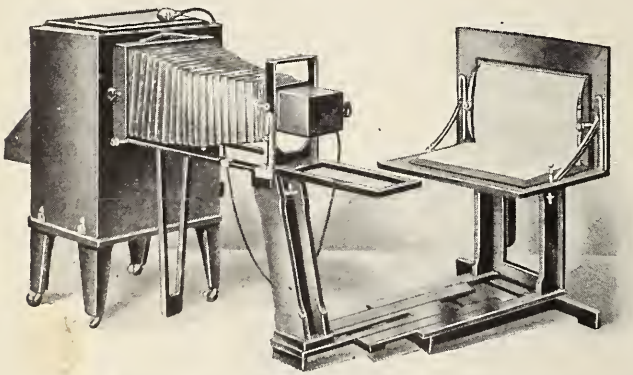
Slip Coach Brought to a Stop at Station

Showing Two Coaches Slipped from Main Section of Train

While there might be lines in America where this system could be used to advantage, its success in England is due to local conditions. An express train in this country is as likely to have passengers waiting to embark at an intermediate station as it is to carry passengers wishing to disembark, but in many of the small communities along the lines out of London the passenger traffic is either to London or back home from London. Consequently, trains running out of London at certain hours of the day have passengers to drop at stations where outbound passengers need not be considered, and the slip-coach method of discharge makes possible a very fast schedule.

LARGE SAILING SHIP DISMANTLED

The "Shenandoah," one of the greatest American wooden sailing ships ever built, has been sold for $36,000 and is being cut down into a barge for the carrying of coal along the Atlantic coast. She cost $184,000 when built 20 years ago. Her main truck was 192 ft. above deck, and her main yard 96 ft. in length. She was a four-masted ship and had a spread of 12,000 ft. of canvas.



This Machine Photographs, Develops, Prints and Fixes

PHOTOGRAPHIC REPRODUCTION OF DOCUMENTS

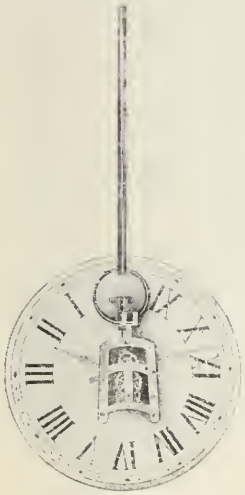
Rapid photographic reproductions of written, printed, or typewritten documents may be made with this machine, which develops, prints, and fixes, as well as takes the photographic impression.

The operation of making a copy of a record or document consists simply in placing the book or loose sheet in the copy-holder, clamping it firmly with the adjustable clamps, and pressing the bulb, which opens the shutter of the lens and allows an image of it to fall upon the sensitized paper. At the completion of the exposure, the shutter is closed by another pressure of the bulb, and the operation turns the crank at the side of the machine until it stops of itself. Then the copy-holder is tilted back, the page of the book is turned, or another loose sheet is placed on the rack, and the operation is repeated.

When the crank is turned following the exposure of the second photograph, the first photographic copy made drops out of the rear of the machine into the receiver.

OVERHANGING PENDULUM ON ELECTRIC CLOCK

Perfection as a time-keeper is claimed for a clock recently made as an experiment in St. Louis, which is operated by electricity instead of gravity. The pendulum is swung over the works instead of under them and its action is controlled by an electric lever. Every time it swings backward and forward, a pin, inserted in the pendulum ball, engages the fork of the movement, on the order of a chronometer escapement. The pallet, which is fastened to the fork, will move the escape wheel every second, as the pendulum swings back and forth. The current operating the lever which governs the pendulum is always the same and therefore the movement of the clock cannot vary the fraction of a second.



MAKING SCIENTIFIC OBSERVATIONS IN THE SAHARA

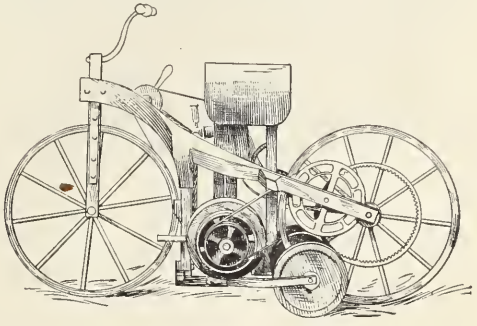
A French expedition under Dr. A. Nodin has succeeded in making important astrophysical and meteorological observations in the Sahara desert. The costumes the party wore and the means of travel, both native, are shown in the illustration. Some of the scientific instruments carried by the expedition were mounted on a camel's back.

Among the points ascertained by the expedition was that condensations and precipitations of vapor of water during the same period of solar and terrestrial troubles are comparable to those which manifest themselves in Europe under the same circumstances.

French Scientist Starting on Sahara Expedition

A MOTORCYCLE OF TWENTY-FIVE YEARS AGO

A motorcycle of 25 years ago, having several features now in use or about to be used on the present motorcycle, is here illustrated. The power plant was a ½-hp. engine using kerosene as fuel, the belt drive was very much like that approved today, and the small auxiliary wheels to prevent skidding are not unlike those now coming into use on the most improved types of British motorcycles.



Motorcycle of 1885

FOUR YARDS OF BEARD

A beard that is more than twice as long as its owner is tall is the boasted possession of Valentine Tapley, a resi-

Record-Breaking Beard

dent of Frankford, Mo. It is exactly 12 ft. long, and has to be wound around the waist or hung about the shoulders to keep it from trailing.

TWO WAYS OF FIGURING TIME IN TURKEY

For centuries the method of reckoning time in Turkey has been based on the assumption that the day ends and the new day begins at sunset, which is called 12 o'clock. Following the lead of the people, who seldom had watches or clocks and judged the time by the position of the sun, the civil and religious administrations used the same system, and clocks and watches made to keep regular mean time had to be changed almost daily to adjust them to the sun.

Now, however, the accurate and scientific reckoning of time as adopted by modern countries is coming into use in the Ottoman empire, although the government has decided not to impose the change by law. As a result, combination timepieces, which show both the time by the sun and the standard time, are in demand. There are three types of timepieces for this purpose. One has two dials, one on each side; the second has two small dials side by side on the same face, and the third has a central fixed dial for regular time, and around it a movable dial for Turkish time.

The standard time will be introduced gradually, and the period of transition will probably extend over several years, during which time both systems will be in use. The building of railroads, which must have accurate and uniform time, will tend to introduce the new system, various administrations have already adopted it, and many of the schools are preparing for the change.

ELECTRIC ADVERTISING SIGNS AT SEA

It has been proposed to erect large electric signs on barges, with the necessary equipment for generating current, and to either anchor them off shore or propel them slowly back and forth in front of the famous boardwalk at Atlantic City. The local authorities at Atlantic City, however, are opposed to the plan, and have strenuously protested to the War Department to stop any such move. Just what right the government may have to interfere is discussed as follows by the Illuminating Engineer:

"From a technical point of view, it is difficult to see what the War Department can do in the matter, except to treat it strictly as to its effect upon navigation. The right of the government to police all waters, within three miles from shore, is unquestioned, but whether this police supervision extends

Chinese Taking Water from Stream Near Sewer

farther than keeping the regular channels of navigation open, may seriously be doubted. A single float, exhibiting an electric sign and anchored off shore, or propelled by licensed navigators, could hardly be called an obstruction to navigation. The real question is, what would happen if other similar enterprises were inaugurated to an unlimited extent? Suppose, for example, that instead of one there were a whole marine parade of such barges, passing back and forth in front of this, or any other resort, every night when the weather permitted. Would it be one of the spectacles which people would gather to see, or, by obstructing the view of the ocean itself, would it become an intolerable nuisance?"

CHINESE WHO DO NOT FEAR THE SEWERS

In this illustration, at the left, is shown the main sewer of the native section of Tientsin, China, emptying into the Peiho River. Almost in front of the sewer, water carriers may be seen getting water for drinking purposes. They are on the upstream side of the sewer, but the current is sluggish and the water carries a considerable amount of sediment. This is settled by letting the water stand in large earthen jars, alum being added to hasten the process.

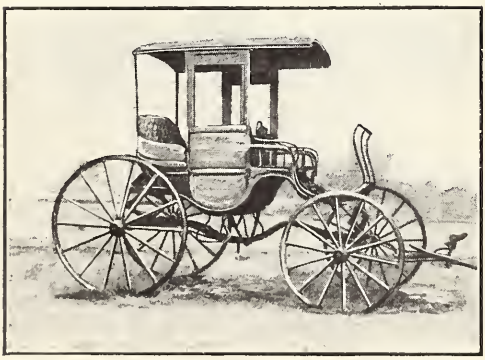
THE USES OF OLD ROPE

Old rope, like old tin cans and other things generally considered as waste, has its special market and uses, and in every seaport the collecting and classifying of old rope is an important business. Rope covered with heavy applications of tar or graphite is even more valuable today for making oakum than lightly tarred material, while hemp rope with the original heavy coating of tar worn off by weathering is often used for bag paper. A small percentage of untarred hemp rope, used in its prime for hoisting and other such purposes, is being converted into cigarette paper in Europe. Scraps and waste from old tarred rope, and also old oakum removed from the seams of ships, are now used for making boards.

FASHIONABLE VEHICLE OF '50'S PROVES DURABILITY

That the carriages of our forefathers were built for durability as well as style is shown by the fact that a carriage built for Stephen A. Douglas in the '50's recently carried four persons in a parade at Grand Rapids, Mich. The carriage was used by a local political organization, it having special significance owing to the fact that it carried Abraham Lincoln and Stephen A. Douglas to their seven joint debates in the fall of 1858. The vehicle cost Douglas $750, and at that time it was considered the finest carriage in the middle west. Lincoln didn't have money to hire a carriage and it was by invitation of Douglas that he rode in this one.

Making Plaster Mold of Sculptured Form



Once Considered Finest Vehicle in the Middle West

MOUNTING THE SKIN OF A GIANT HIPPOPOTAMUS

The mounting of the skin of "Caliph," the hippopotamus which was for 30 years the center of attraction in the New York Zoo, presented many difficulties, all of which, however, have been successfully overcome. The great beast was said to be the largest hippopotamus in the world, being 12 ft. long, 14 ft. in circumference, and weighing four tons. During the first stages of building up the form for the skin, the interior of the plaster body resembled a section of a subway, and six workmen with electric arc lights could move about with ease in the spacious interior.

In the illustration may be seen the giant clay-sculptured form being partly covered with plaster to obtain a mold. It was necessary to make the form in sections, which were afterward assembled. Plaster was then applied to the interior surface of the molds, thus securing the light but firm completed structure.

The working of the huge skin into the numerous deep folds and wrinkles, especially around the massive head, neck and legs, was most difficult. The skin weighed 1,200 lb. when first removed from the body, and in some parts was 6 to 8 in. thick. Six men, working four days, shaved it down to from one-quarter to one-half inch in thickness, and to a weight of 68 lb.

TOY BLOCKS MADE OF CORK

A German toy-maker is manufacturing building blocks of cork as substitutes for the so-called stone building blocks, made of cement or concrete The cork blocks, unlike the heavier articles, do not scratch the finish of floors or tables.

Photo by Paul Thompson, N. Y.

Moving Target Scenery Painted by W. Z. Wyllie, R. A.

ARMY TARGET PAINTED BY FAMOUS PAINTER

The Hampshire Fortress Engineers, of the English territorial army, which corresponds to the national militia of this country, enjoys the unique honor of having had the scenery of its miniature rifle range painted by a member of the Royal Academy. It was executed by none other than W. Z. Wyllie, R. A., whose marine scenes are considered among the finest paintings of present-day artists.

The reason for the honor lies in the fact that Mr. Wyllie is a keen citizen soldier as well as a great painter, and holds the rank of captain in the Territorial Engineers. The scenery of the moving target, which is shown in the illustration with the painter and several of the engineers before it, is a reproduction of the undulating lines of the Portsdown Hills, and has been beautifully executed.

¶The president of Cuba has appointed a commission to consider plans for the construction of the new $500,000 presidential mansion to be built from surplus lottery funds.

EMERGENCY LIGHTING OF PASSENGER SHIPS

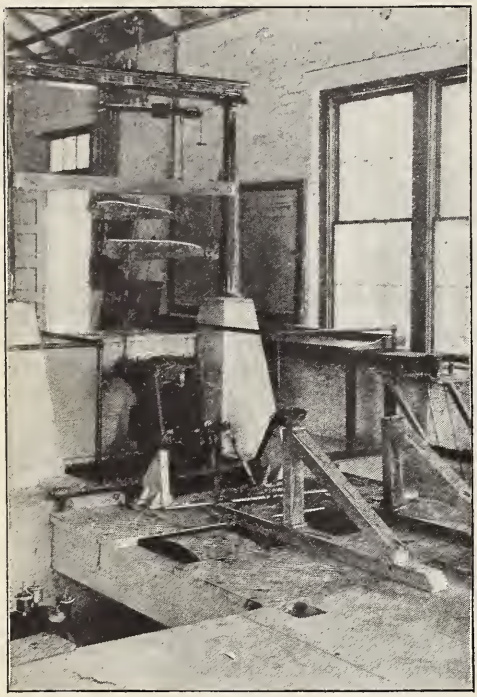
The possibility that the regular lighting circuits of ships may be thrown out of commission by the flooding of the engine rooms or other accident, has called forth many methods of providing emergency lighting.

One of the most interesting is that in use on the passenger steamer "Alabama," which runs out of Chicago to ports across Lake Michigan. A storage battery of 56 cells, capable of supplying 25 4-cp. lamps for 10 hours, is mounted at the highest point of the upper deck, and charged during the day from the ship's generators. The lamps, distributed along the corridors, are kept lighted every night, so that, should the regular plant be rendered useless, sufficient illumination is assured, without the manipulation of switches or automatic devices.

On some of the transatlantic liners, the emergency lights are oil lamps. These are lighted at the same time as the electric lamps, so that, regardless of a possible shutting off of electric current, there will not be a moment of darkness.

UNIVERSITY INSTALLS AUTO-TESTING PLANT

An automobile-testing plant, unique because of its setting and because auto-



Automobile Testing Apparatus of University of Kentucky

mobile owners are asked to have the horsepower of their machines tested free of charge, has been installed at the University of Kentucky, which institution purposes to do considerable research work on the subject of power-plant efficiency.

The plant is so arranged that an automobile can be mounted on two drums revolved by a shaft, the other end of which contains a friction brake. The automobile is held in place in such position that the centers of the rear axle are directly over the centers of the shaft carrying the drums, this axle being connected to a system of levers which is in turn connected to a scale. The scale system is so sensitive that one-fourth of a pound pull can be accurately measured. By means of instruments, it is possible to determine the horsepower of a machine under any conditions of operation, within an accuracy of one-hundredth of a horsepower. The distance traveled by the tread of the rear tires is measured by a recording indicator.

NAVAL TESTS OF INTERNAL-COMBUSTION ENGINES

The conclusions drawn from the series of tests made at the Norfolk, Va., navy yard, to determine the suitable types of internal-combustion engines for naval service, are of much interest and importance to all users and prospective buyers of heavy and medium-duty gasoline engines.

The tests demonstrate, according to Lieut. W. G. Diman, in the Journal of the American Society of Naval Engineers, that no gasoline engine with revolutions above 500 per minute should be installed in any heavy-duty boat, as reliability and durability are most important. The moving parts should be the same as in a standard marine engine, and to box them up in a crankcase is absurd. If a reliable engine is desired, it must be a slow-running one that will have heavy and large parts to meet all requirements. Race-boat weights may run from 10 to 19 lb. per horsepower, but this must not be considered a satisfactory machine for service conditions. Light high-speed engines for heavy and medium-duty boats are not satisfactory for continuous use. They will always give trouble and should never be placed in anything but a speed boat. For all around work, no four-cycle engine, weighing less than 35 lb. per horsepower, should be placed in any boat.

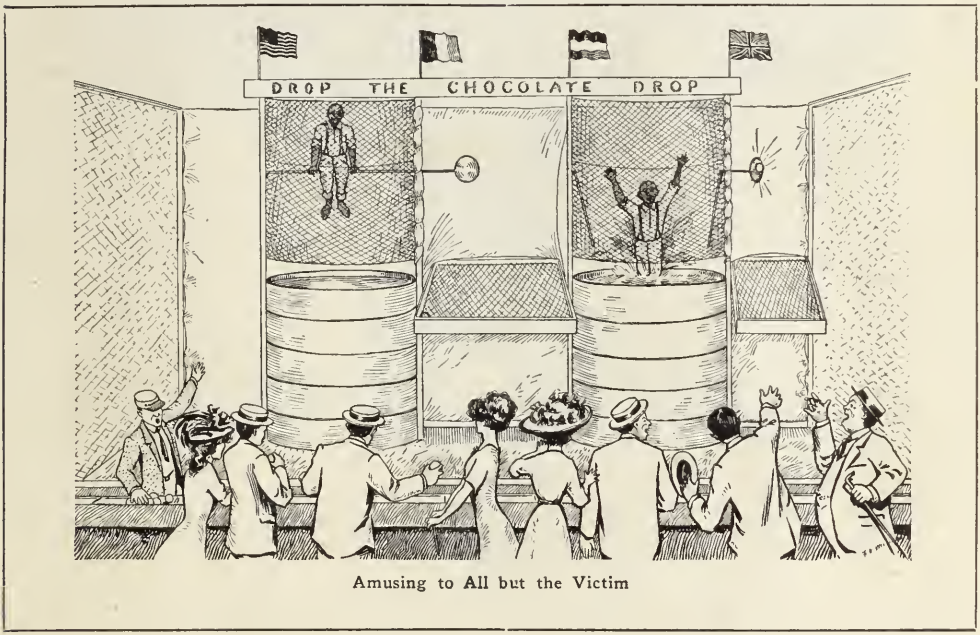
There is a tendency on the part of all gasoline and oil-engine manufacturers to install a number of fittings which are not necessary for perfect operation, says the report. This increases complication without giving better results. There should be nothing in connection with a gasoline-engine equipment that is not absolutely necessary to its running efficiency, and the simpler the installation the better.

SUCCESSOR TO THE "AFRICAN DODGER"

The demand of the public for continual change in the means of amusement leads to many curious amusement ideas, an example of which, very popular at a Chicago amusement park, is shown in the accompanying illustration.

The "African dodger," a game in which a colored man places his head through a hole in a canvas curtain and endeavors to dodge the missiles thrown in his direction, became too old and commonplace to create sufficient interest, therefore, this new idea was evolved. Stretched above a tank of water is a board arranged very much like a trap door. Upon this board the victim sits while the players endeavor to hit a target, placed on the side. Every hit trips a mechanism which causes the board to drop, tumbling the colored man into the water.

The outfit at the Chicago amusement park consists of two such units, so that, when one victim is in the water, another is in position to be tumbled.



Amusing to All but the Victim

HANDCUFF WITH EVERY FIRE ALARM

For a person to be presented with a handcuff every time an alarm of fire is sent in over the wires from a street box, and to receive it in such a manner that to refuse the gift is impossible, seems a rather extraordinary proceeding. Yet such a gift is one inventor's idea of the only way to effectually provide against false alarms.

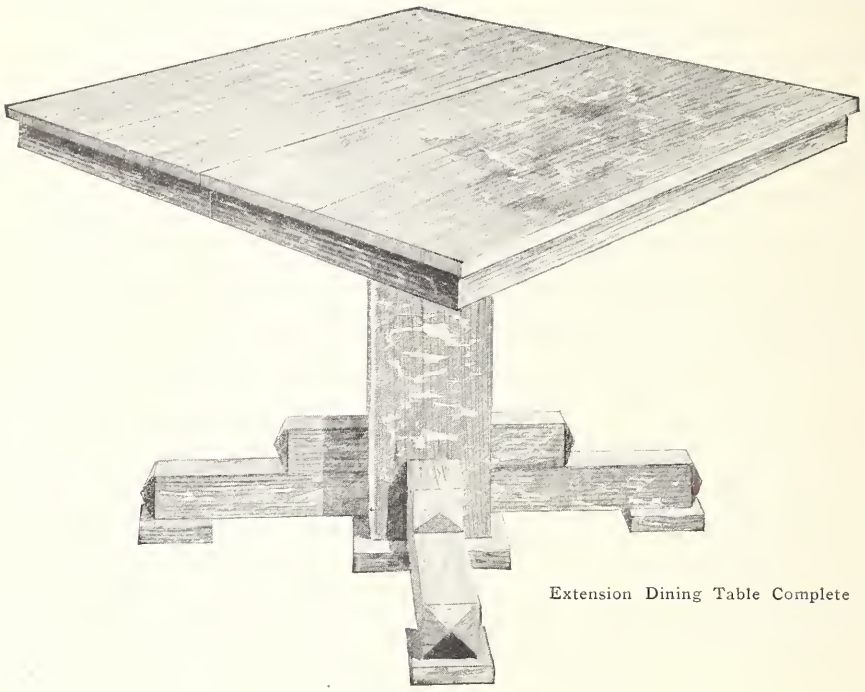
The special handcuff firebox is provided with a cover, which the operator must raise. He is then required to push a button to send in the alarm, which action also causes a handcuff to fasten itself about his wrist. The handcuff, merely being for identification, is not chained to the box, so the person sending in the alarm carries it away with him. It is a handcuff difficult to conceal, being quite large, and must be unlocked by the fire chief. If there is a fire, the wearer of the handcuff is thanked for his presence of mind, but if the alarm is false, a search is immediately begun for its wearer and he is dealt with accordingly.

WIRELESS TELEPHONES FOR USE IN MINES

Experiments carried on near London, Eng., to determine the practicability of the wireless telephone as a means of communication in coal mines, are said to show that instruments of a size that can be grouped into portable form may be successfully used. To give the special apparatus a thorough test, instruments were placed about 1,600 ft. back and at a depth of 100 ft. in the Chislehurst caves and on the top of a hill about a mile away. In the caves, the lines from the instrument were connected with two pitch-forks, driven into the chalk, while the lines from the instrument on the hill were connected to a few 3-ft. stair rods, stuck into the soil. The current was easily picked up and returned, and the two parties communicated without trouble. One of the coal companies in South Wales has contracted for instruments, and will use them in emergencies for intercommunication between the galleries and between the galleries and the pit mouth.

HOW TO MAKE AN EXTENSION DINING TABLE

The accompanying sketch and photograph show a simple design of an extension dining table of the mission style. It is very easy to construct and can be built at home by anyone who is at all handy with tools. It should be made of quarter-sawed oak, which can be secured at the mill ready cut to length, squared and sanded. Order the following pieces:



Extension Dining Table Complete

2 top pieces, 1 by 23 by 46 in.
2 extra leaves, 1 by 12 by 46 in.
2 rails, ¾ by 3 by 44 in.
4 rails, ¾ by 3 by 22 in.
2 pieces for posts, ¾ by 8 by 24 in.
2 pieces for posts, ¾ by 6 by 24 in.
4 pieces for feet, 3 by 3 by 14 in.
4 pieces for feet, 3 by 3 by 5 in.
4 pieces for feet, 1 by 4 by 4 in.
4 pieces moulding, 1 by 1 by 10 in.
1 piece, 1 by 12 by 27 in., birchwood.
2 brackets, ¾ by 3 by 32 in., birchwood.
2 pieces for slide, 1¾ by 3 by 36 in., birchwood.
4 pieces for slide, 1 by 3 by 36 in., birchwood.
12 pieces for slide, ¾ by 1½ by 36 in., birchwood.

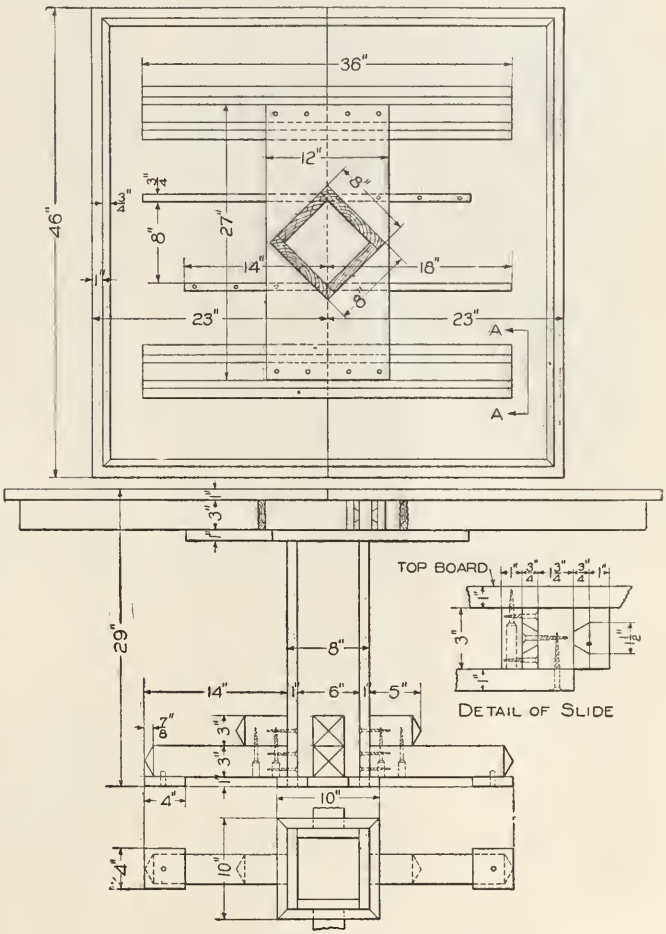
The feet can be made first by squaring up one end of each and beveling the other as shown in the drawing. The short pieces are fastened to the long

ones by means of long screws and glue. The four square pieces should be nailed to the outer ends and holes bored in them for the casters. Prepare the pieces for the posts, and before nailing them together fasten the feet to them with long screws. Be careful to get them on square, else the table will not set level when complete. Now nail and glue the pieces forming the table together and fasten the moulding at the bottom. This moulding should have mitered corners as shown in the bottom view. Also fasten the rest piece to the top of the post, using long screws and glue.

The slides can be made next. The pieces are made and fastened together with screws as shown in the enlarged detail view. This slide, if made with care, is a good one. The center piece should be firmly fastened to the post rest with long screws. The screws that fasten into the top should be inserted from below through counter-bored holes as shown.

Miter the rails at the corners and glue them to the top. Blocks can be used on the inside if desired, which will make a much stronger construction. Screw the two brackets to the top as shown. These help to support the table when it is extended.

When complete, the table should be carefully gone over with fine sandpaper, and all glue and rough spots removed. Apply stain of the desired color. This can be any one of the many mission stains supplied by the trade for this purpose.



Details of Dining Table

SUBMARINES TO SERVE AS WATER CARRIERS

Two of the oldest submarines of the French navy, the "Gymnote" and "Gustave Zedel," are being converted into tank vessels for the carrying of water, which is a strange fate indeed for craft built to travel under water. Purposely using their holds for water, however, is a fate less tragic than that suffered by several French submarines, notably the "Pluviose," the flooding of whose holds caused many deaths.

¶An English motorist is to undertake to drive an automobile from the Cape to Cairo.

PLACING A TURRET ON FRENCH BATTLESHIP

The lowering into position of a great two-gun turret on the French dreadnought, "Voltaire," may be seen in this

Funnel-Like Shape of Battleship Turret

illustration. The long stem, giving the turret a funnel-like appearance, goes down into the hold, the turret when in place being no higher above the deck than those of the fighting ships of other nations.

NAMING MOTORCYCLES A NEW CRAZE

Here and there in this country may be found a motorcycle bearing a name, but in England the idea has developed into a craze that is spreading like wildfire, and may be taken up enthusiastically in this country, should some scheme of registering be decided upon.

Wherever motorcycle enthusiasts meet in England the naming of machines is the topic of conversation, and nearly every machine now has its name painted on the gasoline tank. Registration headquarters have been arranged and no name is accepted for record that has already been registered by some one else.

The names given the machines by their owners are of a varied nature, including the humorous, the appropriate, and the grotesque. Among the hundreds of names already registered are found "Grey Ghost," "Fossil," "Puffing Billy," "P'raps," "Red Rat," "Autogo," "Tired Tim," "Gatling Gun," "Flying Dutchman," "Mighty Atom," "Red-ot," "Creeping Jimmy," "The Snail," "Non-Stop," "Rob Roy," "Salome," and "Arrow."

IRON REMOVED FROM GRAIN BY MAGNETS

Explosions in flour mills and breweries, often caused by nails or iron particles that find their way into the grain, and which, when they strike the steel rolls of the mills produce sparks and ignite the finely pulverized material about them, have resulted in an electro-magnetic method of removing such foreign matter.

A large malting concern, according to the Engineer, was so troubled by such explosions that all the grain is now passed over magnets before being prepared for shipment to the breweries.

Where the Motorcycle Names are Placed

The cleaning capacity of the electro-magnets installed is 800 to 1,000 bushels per hour. When the magnets have collected a large amount of metal, they are swung to one side and swept clean.

CHINESE PLAY FRENCH ARMY GAMES

Of all the foreign soldiers quartered in the principal cities of Northern China as a preventive against Boxer uprisings, the French are said to be the most welcomed by the natives, many of whom enter into the sports of these guardians of peace.

The two games pictured in the illustrations are very popular in the French army, and doubly so in China where the natives, young and old, take part. One of them is a thread-eating game, and in the other the players strive to bite coins from a sticky, sooty hanging object.

In the former, cotton threads, all of equal length, are tied about 3 ft. apart to a rope stretched along the ground. The participants in the game take the loose ends in their mouth, and, at the given signal, commence to chew it up. The thread is chewed up into a wad, not swallowed, and the participant reaching the rope first wins the prize.

Thread-Chewing Contest

In the other game, a cardboard box or other like object is coated with a sticky, sooty substance, and against this surface coins are stuck. The box is then suspended at the proper height, and two participants at a time try to acquire the coins by biting them off. The box is swayed back and forth by the efforts of the participants, and by the time the coins are all captured the sticky, sooty substance is plentifully daubed over their faces, to the great amusement of the onlookers.

Acquiring Coins under Difficulties

Since the year 1900 the powers have maintained an army of occupation in Northern China.

COLOR DESIGNS "FIRED" INTO THE GLASS

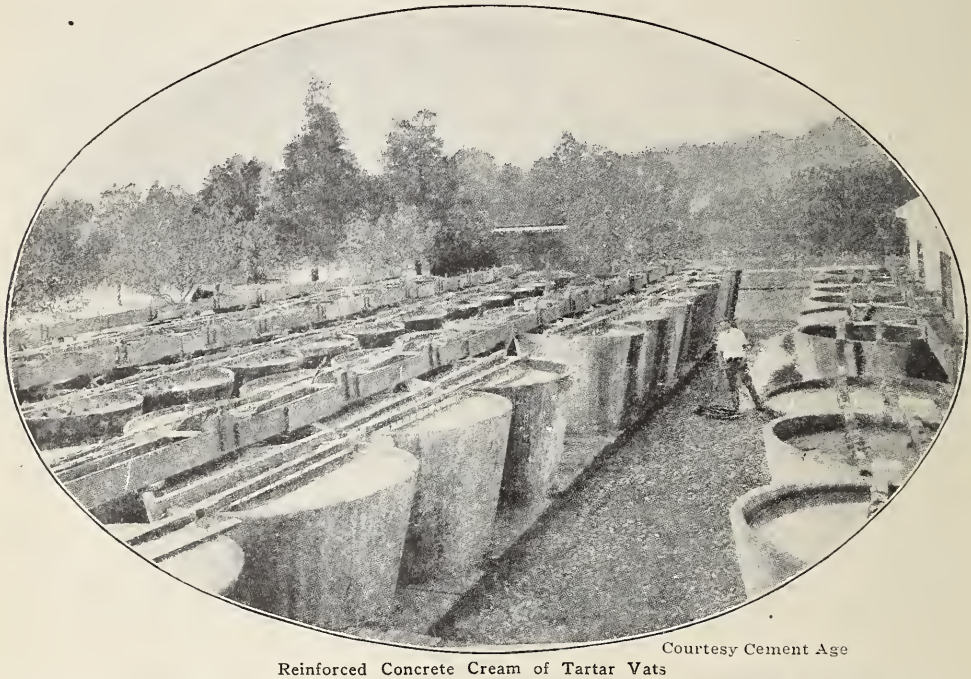
A new form and method of making stained glass, said to be far superior to the ordinary stained article with heavy lead and metal lines, has been adopted by an American concern. The glass itself first receives the pattern in mineral pigments, and it is then "fired" into the glass by heat so intense that glass and color become fused into an impervious whole. At the same time the face

of the glass receives a curiously pebbled surface which gives the colors a softened, mellow character.

Each panel is bent separately into shape by the application of heat and is complete in itself, requiring only to be assembled in a metal frame to form the complete picture. Every part of the pattern is said to be transparent, no matter how intricate the design.

bottom and sides of the vats and to whisks of hemp suspended from the center.

The size of the vats as compared with that of a man is shown in the illustration.



Courtesy Cement Age

Reinforced Concrete Cream of Tartar Vats

MAKING CREAM OF TARTAR IN CONCRETE VATS

One of the important by-products of the great wine colony at Asti, California, is cream of tartar, obtained from the lees or sediment of the new wine. Nearly 50 reinforced concrete vats, 4½ ft. in height, 19 ft. top circumference, and 13 ft. at the bottom, receive the hot lees, carried to them from the distillery by a sluice system.

The liquid is allowed to stand in the vats until it is as cool as the atmosphere will make it, the time usually required being five or six days, during which period the cream of tartar is precipitated. The crystals adhere to the

WOODEN WATER PIPES TO BE USED IN AUSTRALIA

Wooden water pipe, ranging from 3 to 12 ft. in diameter, is being manufactured by a new factory in Sidney, Australia, to supply the requirements of inland towns, mines and industrial concerns. In some of the important towns, large steel pipe laid down several years ago is actually crumbling to dust, and it is expected that the wooden pipe will more effectively resist decay.

The lesser cost of wooden pipe and its transportation are also important factors. Many towns wish to install pipes, but have not the taxing power to do so. It is estimated that with inland towns a saving of 50 per cent of the cost of metal pipe is possible. A 3-in. wood pipe to withstand a 100-ft. head pressure, for example, would cost

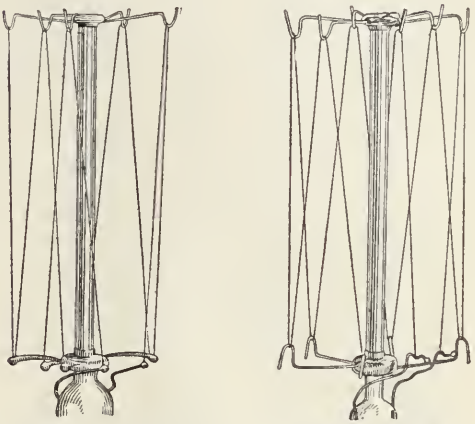
about 21 cents per foot, while cast-iron pipe for the same requirements would cost approximately 45 cents, and steel 38 cents. A 12-in. wood pipe costs 72½ cents, against $1.55 for cast iron. The saving in freight is also a big item, the 3-in. wood pipe weighing but 4 lb. per square foot as compared to the 12 lb. per square foot of cast iron. The 12-in. wood pipe weighs 15 lb. per square foot, as compared to the 77½ lb. of cast iron.

The process of manufacture is very similar to that of the wooden stave pipe used for the great pipe lines in the western part of this country. The stave pipe is dressed on both sides with galvanized steel wire, and then covered with a heavy coating of bituminous composition and wrapped with hessian cloth.

IMPROVEMENT IN MOUNTING TUNGSTEN FILAMENTS

The only drawback to the tungsten lamp is its fragility. A slender rod or thread of it has a comparatively great tensile strength and can be bent, but it is fragile and a slight blow shatters it. Much of the breakage, however, is due to the ordinary method of mounting the filaments in the lamp, which has now been improved in what is known as the wire type.

The ordinary method is to mount the filaments (which are made in short lengths of hairpin shape) with the ends passed through metal balls fused at the ends of the supporting wires, thus making a total of eight or ten points of rigid support. The "wire type" of filament, which is continuous, is made possible by the development of a new method of manufacture by which it is produced in lengths. A few turns near each end of the filament are wound in the form of a spiral spring around the respective leading-in wires. Consequently, a slight bending of the filament from a blow or vibration does not act directly upon the fused joint, as it would if a straight part of the filament came directly from the fused joint as in the ordinary construction, but upon the spiral spring.

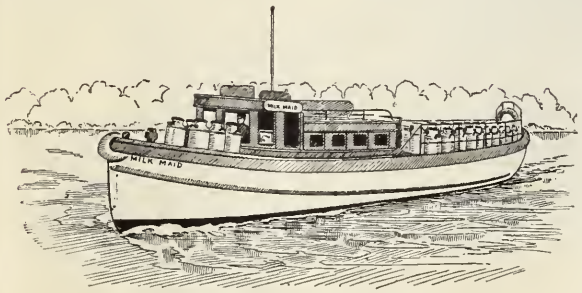


Old Method of Mounting Tungsten Filaments

New Method of Continuous Filament

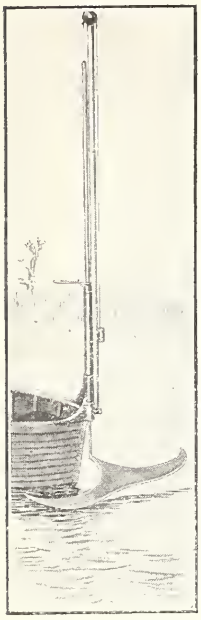
A MOTORBOAT MILK MAID

This powerful 45-ft. motorboat, appropriately named the "Milk Maid," gathers the milk output from the pasture lands along the Sacramento River and delivers it each day to the city of Sacramento. Put into service as an experiment, it has reduced the cost of milk transportation to about one-half as compared with the old method of shipping by rail. The boat makes two 20-mile trips, absolutely on schedule, seven days a week, driven by her 54-hp. engine at a speed of 14 miles an hour, and has a carrying capacity in milk cans of 600 gal.



Transporting Milk by Motorboat

UNDER-WATER WEED-CUTTING DEVICE



An inexpensive weed-cutting device, designed for the clearing of small lakes, ponds, and streams, is being placed on the market. The cutting knife, 5 ft. wide, and shaped somewhat like the blade of a skate, is rigged to a standard fixed in a central position on the bow of the craft being used for the operation. It will cut weeds at a depth of 6 ft., the knife working with an oscillating motion, due to its peculiar shape.

TWO AUTOMOBILE FLUSHERS FOR TORONTO

Two automobile flushers are now being used for the cleaning of the streets in Toronto, Canada. Driven by 40-hp. engines, the two machines work in company, one going ahead and loosening the dust while the second follows about ten minutes later and washes it to one side. A 60-ft. street can be flushed from curb to curb in one trip, the tanks having a capacity of 1,200 gal., and the machines traveling at a speed of eight miles an hour while operating.

Auto Water Wagon

SIAM'S EXPORTS OF BIRDS' NESTS

The nests of a species of birds belonging to the family of swifts, and inhabiting the islands off the coast of Siam, are delicacies which the Chinese consider very fine in the making of soup. The demand for the nests in Hongkong so exceeds the supply that the prices range from $15 to $25 per pound, according to quality, while the average price for the total annual product is about $7 per pound.

The export of bird's nests from Siam during the last year amounted to 17,781 lb., valued at $109,848, most of which was used by the Chinese cities. The nests consist almost entirely of the salivary secretion of the birds, whose glands are much more developed than those of the ordinary swifts. The season for the gathering of the nests begins in April and ends in September. The Chinese regard them as a valuable tonic as well as a delicacy.

The Manufacture of Artificial Ice

By J. GORDON OGDEN, Ph. D.

Professor of Physics, Fifth Ave. High School, Pittsburgh

MAN has always been able to provide against the rigors of winter, and to protect himself from the inclemency of the weather when the sun has withdrawn its kindly influence. Whether it was the cave of our remote ancestors, or the steam-heated apartments of today; the skins of animals, or the finely woven cloth of modern times, man has always been able to fight his mortal enemy, cold. On the other hand, he has been practically at the mercy of the broiling sun during the summer season, for thousands of years. Occasionally he stored up some of winter's ice in caves or ice-houses, or else brought it at great expense or trouble from the glacier fields, if they chanced to be within a reasonable distance. The great mass of humanity, however, had to stand the baking and the sweltering, with as little perspiration and as much philosophy as possible, until the advent of artificial ice.

Today, every city, town, or village has its up-to-date ice plant, and ice within the past quarter of a century,

FIG. 1

The watch crystal contains ether. The rapid evaporation produced by blowing upon it, causes a thin film of water between the watch crystal and block of damp wood to freeze.

has become a necessity instead of a luxury.

The principle involved in the manufacture of ice is exceedingly simple. Withdraw sufficient heat from water—the result is ice. The tiny little quiverings that constitute heat are the arbi-

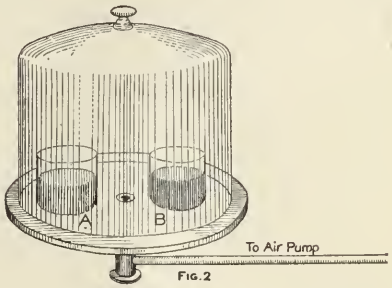


FIG. 2

A contains water; B, sulphuric acid. The lowering of air pressure and consequent evaporation of water, causes the remaining water to freeze. The acid absorbs the vaporized water.

ters that determine whether a body shall be solid, liquid, or gaseous. Man has known this for centuries, but it is only within comparatively recent years that he has made practical use of his knowledge.

Professors in hundreds of colleges and high schools, during the past century, have produced ice artificially before their classes, but the operation ended with the formation of a thin sliver of ice in the heated class room. The pupils were duly impressed, exclaimed: "Wonderful,"—and then passed on to the next experiment. No one bothered about the important principle that had just been demonstrated. No one thought of its meaning and its possibilities. No one saw in it the lessening of infant mortality, the husbanding of perishable products of farm and mill, and the possible addition to the sum total of the world's happiness and comfort.

Figure 1 is a representation of the simple apparatus by which ice in small quantities may be made experimentally. A thin watch crystal, covered with a film of water on its lower side, is placed on a block of moist wood. A little

Copyright by H. H. Windsor

ether is poured into the glass, and a blast of air is directed against the ether. The ether rapidly evaporates owing to the relatively large volume of air that comes into contact with it. There is a price to be paid before a liquid can become a vapor or gas. This price is heat. We see this illustrated every day in the kitchen when the housewife boils water on the hot stove.

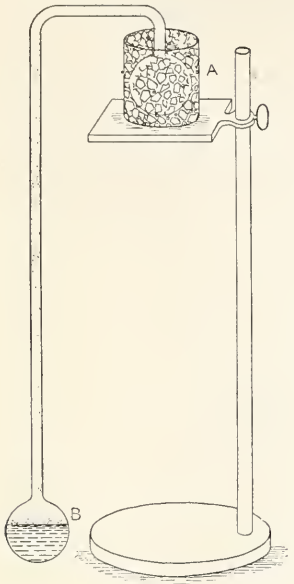


FIG. 3
A is empty, except for water vapor. It is surrounded by freezing mixture. Ice forms on surface of water in B

The ether has to steal the heat necessary to enable it to soar into the kingdom of vapor, and it steals it from the nearest object, namely, the watch glass. The watch glass, in turn, robs the thin film of water underneath of some of its heat, and as a result, since the water has lost the vibrations that enabled it to exist as water, it is reduced to ice.

Figure 2 represents another experiment, full of significance, and performed millions of times in the last century. A glass of water is placed under the bell jar of an air pump, and beside it, a cup of sulphuric acid. When the air is withdrawn from the receiver, the lessened atmospheric pressure on the water stimulates evaporation. The water in the glass takes advantage of the excursion rates into the vapor state, borrows the price in heat units from the water remaining in the glass, and evaporates. The sulphuric acid promptly absorbs the venturesome vapor, leaving the air in the receiver as rarefied as before. More water evaporates, all at the expense of the water remaining in the glass. Finally enough heat units are taken from the water to lower its temperature to the freezing point. Further evaporation produces ice.

About 40 years ago, Edmund Carre, a Frenchman, made use of the principle involved in the above experiment, in freezing water in decanters for use in the restaurants of Paris. The apparatus employed by Carre resembled a small steam boiler. This was partly filled with pure sulphuric acid and connected by pipes with an air pump and the flask containing the water to be frozen. The working of the pump caused the water to freeze by self-evaporation, the vapor being taken up by the concentrated acid. The acid was constantly agitated to prevent the formation of a layer of dilute acid on the surface. By this method ice was made at a cost not exceeding one-half a cent per pound, as the dilute acid produced in the operation could readily be sold for a variety of purposes, and was in no sense a waste product.

Another experiment that has delighted and bewildered the boys and girls of our higher schools for many decades is that of the cryophorus. With this bit of simple apparatus, ice has been made to appear in a hot classroom, right before the eyes of the interested students, even though the freezing mixture used was quite remote from where the ice finally appeared. It consists of a sealed tube with bulbs at either end. Only water and the vapor of water is contained in the apparatus. All the water is first shaken down into the lower bulb. Then the upper bulb is placed in a freezing mixture of ice and salt, as shown in Fig. 3.

In a few minutes, crystals of ice appear in the lower bulb, contrary to what the average person would expect, as the water thus frozen is far as possible from the freezing mixture. This is the explanation. The freezing mixture around the upper bulb rapidly

cools the invisible water vapor in the upper bulb, and causes it to condense. This lowers the vapor pressure on the water in the lower bulb, and renders its evaporation more easy. Evaporation rapidly follows as a consequence and the vessel is soon filled again with water vapor. Evaporation requires heat. This heat is taken from its only possible source—the water remaining in the lower bulb—and as this process goes on continuously, this same water is robbed of its heat units, sufficiently to cause it to go into bankruptcy, in other words, into ice, and the mystery is explained.

We are all quite familiar with the pulse glass shown in Fig. 4. This apparatus has something very important to tell us in our study of the manufacture of artificial ice. The liquid contained in the pulse glass is sulphuric ether which boils at the low temperature of 95 deg. F., just about three degrees below the normal temperature of the human body. When the hand is placed around the bulb containing the ether, the ether rapidly moves over to the other bulb, where it soon begins to boil vigorously. At the instant the boiling begins, the hand on the empty bulb experiences the sensation of extreme cold.

As a matter of fact, the ether abstracts some of the heat from the hand in order that the boiling (evaporation) may go on, thus showing in an objective way, that heat is necessary to change a liquid into a vapor. An-

FIG.4
Pulse Glass

other fact of great importance that must not be lost sight of is that heat is required not only to change a solid into a liquid, or a liquid into a vapor, but also to permit a vapor or gas under great pressure to assume a condition of less pressure—in other words, to allow it to expand. Compressed air, for example, if released through a small orifice will expand, but the expansion is at the cost of sundry heat units that will be absorbed from any substance capable of parting with them in the vicinity of the expanding air. As a matter of fact, compressed air is one of the first gases used in the manufacture of artificial ice, but compressed air has given place to other gases that use the latent heat of gases rather than their sensible heat.

There are practically only three substances that are used today as ice-makers and of these three, the last is by far the favorite. These substances are: liquid carbon-dioxide gas (the gas that is dissolved in water to form "soda water"); liquid sulphur-dioxide gas (the gas that is formed when sulphur is burned in air); and liquid ammonia gas.

Of course ether is a first-class refrigerant, but the comparatively high cost of this substance, and the fact that it forms a highly explosive mix-

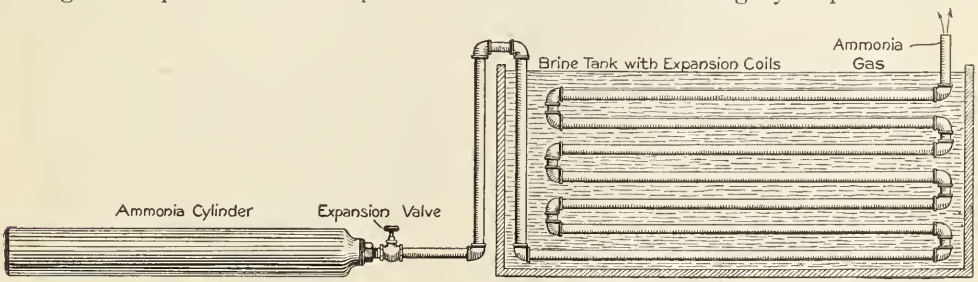
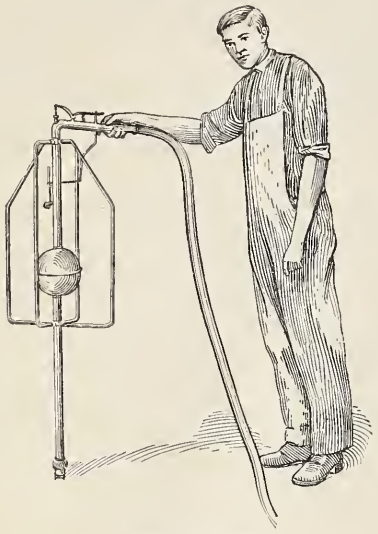


FIG.5
Elemental Ice Apparatus

ture with ordinary air, puts it out of the running with its rivals. The objection to carbon-dioxide is based on

the fact that it can be worked only under very high pressures, varying from 900 lb. to 950 lb. per square inch, while sulphur-dioxide and ammonia work at very low pressures.



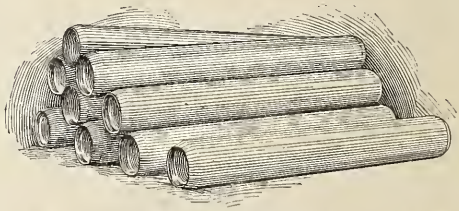
Filling Device

Ammonia is the gas most commonly used today as a refrigerating medium. It is cheap, easily compressed, and is easily deprived of any moisture, thus forming what is known as anhydrous ammonia. Ammonia is a gas made up of one atom of nitrogen and three atoms of hydrogen. It may be generated by heating animal products such as hair, horn, dung, hoofs, nails, etc. The common name for it, in fact, is "spirits of hartshorn," referring to the ancient mode of manufacture. Ammonia gas is a curious substance. Made up of two odorless gases, it nevertheless possesses one of the most powerful odors known to chemical science. The ammonia so commonly used in our households is simply an aqueous solution of the gas.

When the pure gas is compressed and cooled sufficiently, it becomes a liquid, and it is in this form that it is used as an ice-maker. When liquid ammonia is permitted to evaporate under ordinary atmospheric pressure, its temperature is 28.5 degrees below the Fahrenheit zero. If the pure, anhydrous, liquid ammonia is cooled to a temperature of 115 deg. F., it becomes solid, and, curiously enough, it loses almost all of its characteristic odor—one of the marvels of low temperature. At a temperature of 900 degrees F., ammonia gas breaks up into its constituents, nitrogen and hydrogen. The boiling point is about —28 deg. F., its specific gravity is about ⅝ of that of distilled water, and a gallon of it weighs 5.3 lb. Its latent heat of evaporation is about 530 thermal units at a temperature of 32 deg. F.

The ammonia used in ice-making is derived from ordinary soft coal. When soft coal is distilled, a very complex product is the result. Ammonia is one of the gases given off, and is taken up by water. The ammonia water thus formed is heated, and the gas driven off, rendered anhydrous, compressed into the form of a liquid, and is then driven into steel cylinders. These cylinders contain 100 lb. of pure anhydrous ammonia, and are never quite filled, in order that room may be allowed for the expansion of the liquid arising from variations in temperature.

The cylinders containing the ammonia are connected to long coils of iron pipe, and the gas allowed to escape into them, through a valve. Immediately, like a school boy let out for a recess from a pent-up school room, the liquid ammonia scampers through the pipes, rejoicing in its newly found but temporary liberty. The liquid speedily changes to the gaseous



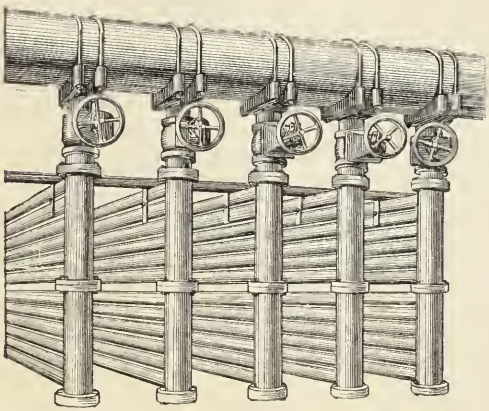
Steel Cylinders, Each Containing 100 Pounds of Pure, Liquid Ammonia

form; but, as has been demonstrated in the experiments described in the beginning of this article, such change of state demands heat, and the heat is

immediately taken from the iron coils. These expansion coils may be exposed to the open air, in what is known as the direct expansion system, circling a number of times about a room designed for cold storage purposes. If the object is the production of ice, the expansion coils are immersed in a heavy brine, into which are placed large oblong iron boxes, filled with water.

The expanding gas robs the coils of some of their heat; the coils in turn take heat from the brine; the brine takes it from the iron boxes; the iron boxes in turn absorb it from the water, and the water freezes.

Figure 5 will give one an idea of the arrangement, diagrammatically, of the different elements entering into the process. An apparatus of this kind, as shown in the figure, would be expensive in operation, as it does not provide for the saving of the ammonia gas. This gas costs about $200 per ton of ice making capacity. Accordingly the ammonia, after it has done its work, and is quite hot, is not allowed to escape, but by means of condenser pipes, over which large quantities of cold water are constantly flowing, is cooled, and then by means of powerful com-



The condenser which lowers the temperature of the compressed gas, to enable it to return to liquid form.

pressor pumps, caused to reassume the liquid form, and may be used over and over again, none of it being lost in the process.

The floor of an ice plant looks like an enormous checker-board. The squares are the wood covers of the iron tanks immersed in the brine. It takes about 48 hours to freeze the

The Finished Product

water thoroughly, and thus make a block of ice of the size and dimensions so familiar to the passers-by on the streets of our cities. The reason it takes such a long time to freeze is due to the fact that the ice forms first along the six sides of the container. This makes an insulating coat that hinders the absorption of the heat units from the interior of the ice box so formed.

A device, called a "filler," is used to place exactly the right amount of water in each tank. A float automatically shuts off the water supply by releasing a trigger when the tank has received its exact quota. The tanks are filled from the bottom upwards, an important matter, as it prevents the admission of air to the water. It is quite curious that air, although perfectly colorless itself, will make "milky" ice. The same phenomenon may be observed when the "white" of an egg is beaten briskly, or when the propeller of a steamship vigorously churns the water.

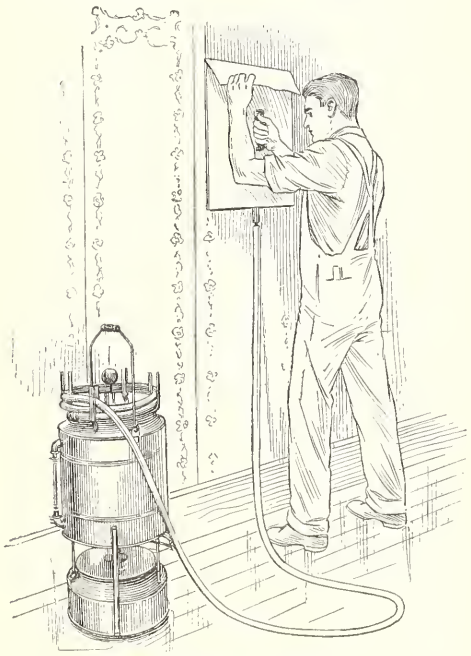
An ammonia compression plant consists of practically four parts: The

expansion coils, the compressor into which the gas is drawn and compressed, the condenser, which lowers the temperature of the compressed gas sufficiently to enable it to return to the liquid form, and the receiver where the liquid ammonia is stored until it is needed for another ice-making tour.

It requires 45 cylinders of ammonia of 100 lb. each to make 100 tons of ice. In many ice factories the water ordinarily is not pure enough, and a distilling plant is a necessary adjunct. As regards the quantity of pipe used in the best factories for condensation purposes, it requires about 320 ft. of 1½-in. pipe to the ton of the ice-making capacity. The brine is generally made from common salt, but calcium chloride forms a better brine that will not freeze, as occasionally happens in the case of salt brine.

OLD PAPER STEAMED FROM WALL

A wallpaper remover which steams the paper from the wall, taking off four or five layers as easily as one, and working almost as rapidly as the steaming-pan can be drawn over it, is here illustrated.



Steam Wallpaper Remover

Steam is generated in a few minutes by a heater placed in the center of the room, and is conveyed by a hose to the steaming-pan. Two of these pans are provided, one being as wide as the ordinary width of wallpaper, and the other for use in spaces of awkward size. Both are simply held against the wall and drawn down the strip of paper from coping to baseboard, the operator pulling the paper away from the wall as fast as the pan is drawn over it.

The greatest objection to wallpaper has always been that it is a germ trap if left on, and yet is very difficult to remove. In some cities laws have been enacted prohibiting repapering without first removing the old layers. This machine is said to remove the paper of a room of ordinary size in from one to two hours.

RADIO ACTIVITY IN AUSTRALIA

Radio-active mineral is being found in Australia, and efforts to provide for general medical use, free, when patients are unable to pay for the treatment, are being made by the government of New South Wales.

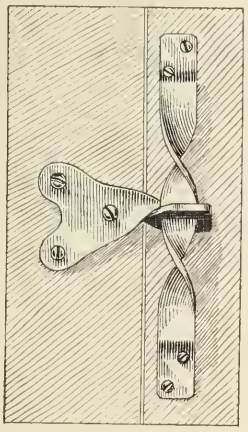
The last reports from the prospect in South Australia, near the New South Wales border, state that a shaft has been sunk 130 ft. and a large, strongly defined reef is showing. The black ore carries large patches of bright yellow carnotite, which is highly radio-active.

Medical authorities of Sidney have made an appeal for $10,000 to be used for the purchase of radium for the hospital, and considerable of the amount has already been subscribed. The radium so purchased will be devoted to treatment of persons of small means.

The most important step, however, is that taken by the government of South Wales, which proposes a state radium bank, such as is in operation in Paris and London. The scheme is to make the treatment of cancers, and other like diseases, by means of radium, available, not only to every hospital, but to every private practitioner in the state. The bank would hire the radium out to the private practitioners, while an ample supply would always be kept on hand for the use of any recognized public hospital for the free treatment of patients of small means.

HINGE THAT CLOSES DOOR

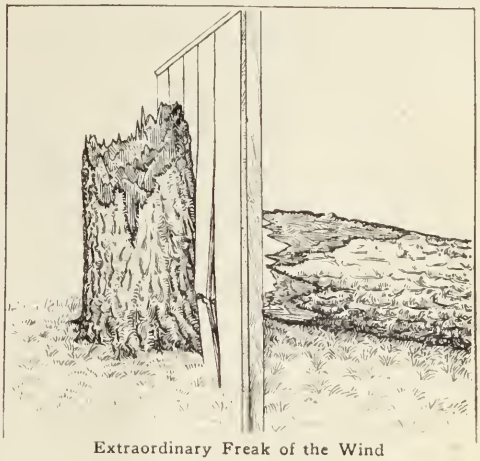
The spiral hinge here illustrated automatically closes the door, gate, or other object to which it is attached. The moment the door is swung open it starts to rise on the spiral, and, when let go, closes by force of gravity.



¶A manufacturer in New York has devised an electric clock with a phonograph attachment to be used for advertising purposes. The talking machine tells the story while pictures of the articles to be advertised are flashed on a transparency.

BIG TREE HURDLES FENCE

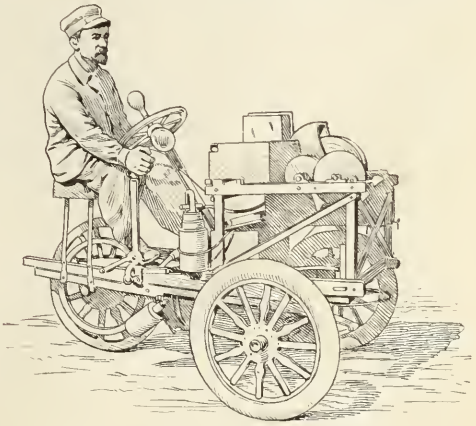
That a large pine tree could be broken off by the wind and blown over a fence without harming the latter seems extraordinary, but just such a curious freak of the wind is shown by this illustration. The tree stood close beside a high board fence, the top of which rises above the point where the tree was broken off. The force of the wind lifted the heavy trunk above the fence top and dropped it on the other side, the only damage to the fence occurring near the bottom, after the tree had struck the ground.



Extraordinary Freak of the Wind

MOTOR TRICYCLE GRINDSTONE

That keeping abreast of the times in all kinds of industry, even though it be of a very small and humble order, is worth while, is demonstrated by the success of this scissors' grinder. The motor tricycle, which, by the way, he made himself, carries him from place to place and also furnishes the power for his grinding apparatus.



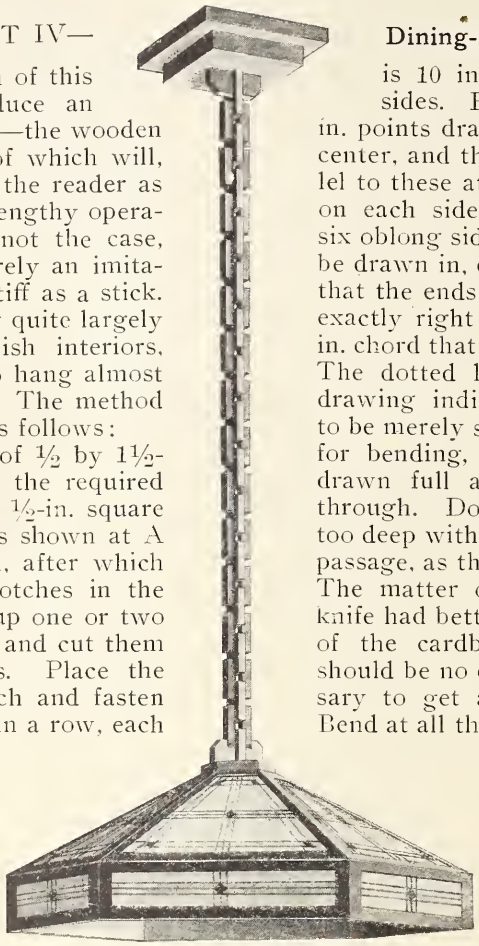
An Up-to-Date Scissors Grinder

¶About 800 aeroplanes have been built in France, to date.

THE MAKING OF ARTS-CRAFTS LAMPS

By JOHN D. ADAMS

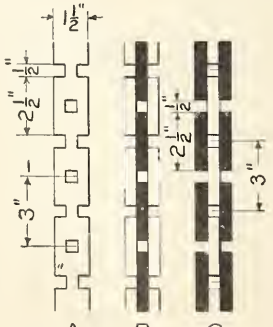
PART IV—



Artistic and Easily Made

IN the construction of this dome, we introduce an entirely new feature—the wooden chain, the making of which will, at first sight, strike the reader as a very tedious and lengthy operation. But such is not the case, for our chain is merely an imitation one and is as stiff as a stick. Such chains are now quite largely used in mission-finish interiors, and may be used to hang almost any form of shade. The method of making them is as follows:

Plane up a strip of ½ by 1½-in. stuff, as long as the required chain, and then cut ½-in. square holes every 3 in., as shown at A in the detail sketch, after which cut ½-in. square notches in the sides. Next plane up one or two ½-in. square strips, and cut them into 2½-in. lengths. Place the strip A on the bench and fasten on the little blocks in a row, each block occupying the space between two square holes, as indicated at B, where the attached blocks are shown black. Now turn the strip over and attach a similar row of blocks on the other side, and our chain is complete. Use glue and two wire nails for each block.



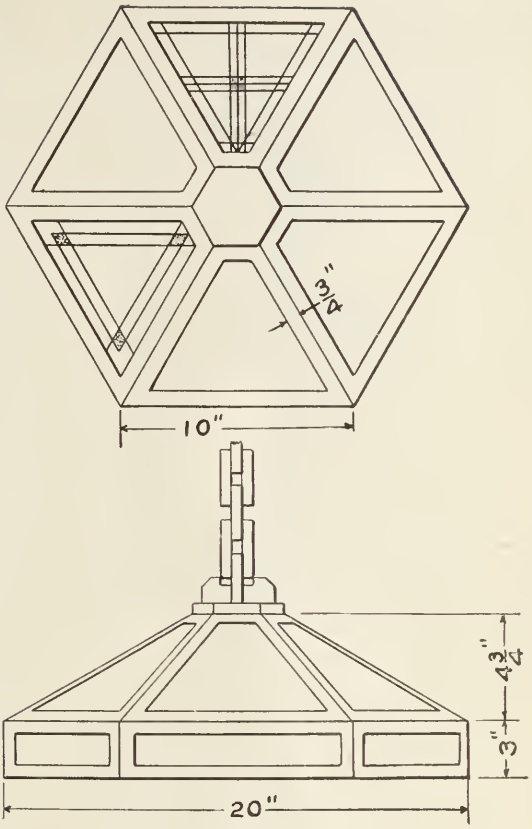
Detail of the Wooden Chain

For the shade, a piece of cardboard, measuring not less than 27 by 30 in., will be required. On this draw a circle of 11½-in. radius, and then step off six 10-in. chords around it —10 in. because our shade

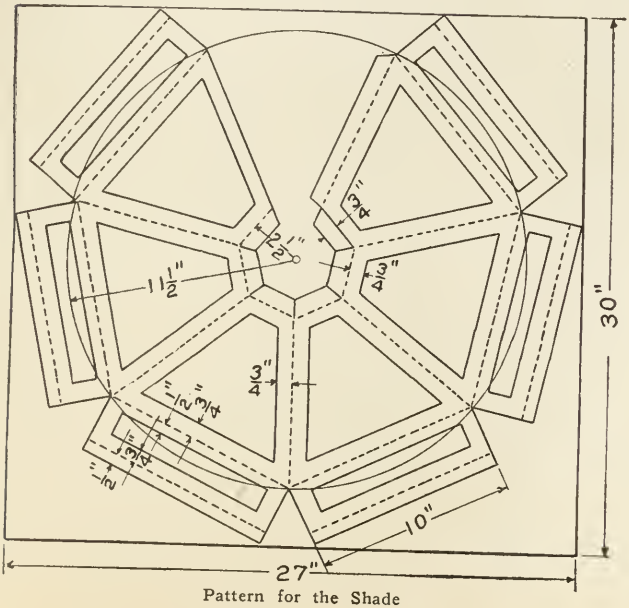
Dining-Room Dome

is 10 in. on each of its six sides. From each of the 10-in. points draw radial lines to the center, and then draw lines parallel to these at a distance of ¾ in. on each side. The lines of the six oblong side panels should now be drawn in, due care being taken that the ends of each panel are at exactly right angles with the 10-in. chord that forms its upper side. The dotted lines in the pattern drawing indicate those that are to be merely scored with the knife for bending, and those that are drawn full are to be cut clear through. Do not attempt to cut too deep with the knife at the first passage, as the hand is apt to slip. The matter of scoring with the knife had better be tried on a piece of the cardboard, as the mark should be no deeper than is necessary to get a good sharp bend. Bend at all the different places before joining the two ends. This bending is best done by placing the line of bend directly over the sharp edge of a table or board and holding the portion on the table down with the straightedge. Any rough or torn edges should be smeared with glue and sandpapered when dry. When all is ready, connect the first and last of the triangular faces with glue. If the cardboard is inclined to be porous, give all the joints a preliminary coat of glue to act as a filler. The shade having assumed its

dome shape, bend down the side panels and connect the adjoining edges of adjacent sections with passe-partout tape, which should also be applied to the connection already made. Go over the entire frame with the drop black. A hexagonal block is now to be prepared, and the six flaps at the top of the dome should be bent inward and fastened with glue and tacks to the under side of the hexagonal block. This completes the shade proper, with the exception of the colored paper triangular panels. If a leaded-glass effect is desired, select some simple design like that shown, and draw it out with the drop black, or still better, with aluminum paint. Among the better class of shades the grape design is often found, and if the reader is something of a water colorist, the decoration of this shade will afford an excellent opportunity for a little talent along that line. In any event use paper that comes in flat sheets, as rolled paper never can be made to look real flat unless it is dampened and placed in a letter press. The pene-



Detail of Frame for Shade



Pattern for the Shade

tration of the light almost always exceeds one's expectations, which makes it advisable to experiment a little before attempting anything elaborate. After the proper color has been obtained, the intensity can be altered by adding one or more thicknesses of paper, or else by the addition of a sheet of heavy drawing paper. For ordinary purposes, a three-light outlet should be procured and fastened to the under side of the hexagonal block, the wires running up the angles of the wooden chain. This completes a very attractive lamp.

"AUTOMATIC FLAGMAN" FOR ELECTRIC RAILWAYS

"Automatic flagmen" are being installed on the lines of the Pacific Elec-

New Crossing Warning Apparatus

tric Railway Co., of Los Angeles, after a series of tests. The feature of the apparatus is a disk pendulum, which swings back and forth when a car approaches. The other warning instruments provided are a trolley-car bell and two electric lights.

About 1,500 ft. from the highway crossing thus protected, a number of 6-ft. sections of contact rails are bolted to the regular tracks. To these are connected starting relays in such manner that the tread of the wheels makes a contact as the car passes over, but there are no moving parts. The passing of a car over the contact-making device simply starts the mechanism actuating the pendulum and gong, which, being provided with a timing element, runs a given length of time before stopping, thus warning all who approach.

INDUSTRIAL PROSPECTS OF ST. HELENA

Lace making, the growing of a fiber like hemp, and mackerel curing are industries on which the island of St. Helena bases its hope of returning prosperity. Since the opening of the Suez canal little but lean, empty years have been felt by the people of the lone, forsaken island where the great Napoleon spent his declining years in captivity. That the island is not the barren rock it has been depicted, and that it is capable of large things commercially is the firm conviction of its governor general, Lieutenant Colonel Gallway, who recently made a visit to London for the double purpose of enjoying a brief rest after seven years' continuous service, and of interesting capitalists in the possibilities of his little province.

Situated about 1,000 miles off the west coast of Africa, removed from the present pathways of trade, the 47 square miles that include all the land surface of the island are covered with verdure and are susceptible of extensive cultivation. The growing of hemp fiber, destined to be used with the best of the Manila product in rope making, has been given much attention by the inhabitants, but capital is required to boom the industry to its fullest extent. The fiber is of good quality, Governor General Gallway states, and can be grown in abundance. Lace that compares favorably with the fabric of the well known European lace makers, is being made in small quantities by the islanders, the industry having been introduced during recent years, and bids fair to become one of the principal products of the island. Mackerel curing employs many of the male members of the population and this also, being in its infancy, has a rosy future, provided the all-needed capital can be supplied.

"Napoleonic traditions are rapidly disappearing from St. Helena," states Governor General Gallway. "There are still a few very old men who were babes at the time of Napoleon's death and who remember—very vaguely—their parents speaking about the famous pris-

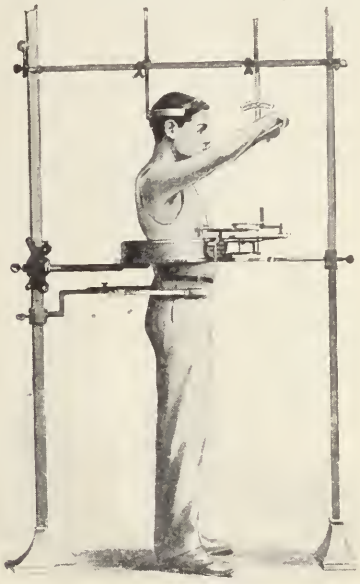
oner. They always refer to him as General Bonaparte. The present generation knows next to nothing of Napoleon the Great, but much more about Dinizulu and General Cronje, who were prisoners on the island, the former in 1890 and the latter in 1900."

MEASURING CHEST MOVEMENT DURING RESPIRATION

The thoracograph is an apparatus by which diagrams showing the movements of the chest during respiration may be obtained. All that is required is to start a clockwork-driven carriage running around the body of the patient, and a pantograph arrangement makes the diagram.

A copper ring, 18 in. in diameter, surrounding the chest of the subject, is the track upon which the carriage supporting the recording apparatus runs. During the revolution of the recording apparatus, a small ebonite wheel, attached to one end of the pantograph, is kept in contact with the chest, side or back by a spring. The other end of the pantograph carries a pen, the point of which rests on a sheet of cross-ruled paper on the top of an aluminum disk. This disk rotates with the same angular velocity with which the carriage moves around the ring, but in the opposite direction, these opposite rotations compensating each other, so that the lines ruled on the paper always remain parallel to their original direction. The pen, and the ebonite wheel which touches the skin of the subject, move radially, and the displacements of the pen are exactly half as large as those of the wheel. The pen, therefore, draws a complete contour of the horizontal section of the thorax of one-half the natural dimensions during the time it takes the carriage to travel completely around the ring.

The subject takes his place in the apparatus, the standards of which are provided with devices to keep him in a rigid position, the ring is set at the proper height, the ebonite wheel is placed in contact with his skin, and the clockwork is wound up. The subject then draws a long breath and holds it while the wheel, started by releasing



Making Diagrams of Respiratory Movement

a catch controlling the clockwork, travels completely around its ring-track. The operation is then repeated with the chest deflated, and the record is made. In the illustration of the diagram the dotted line shows the contour of the chest inflated, and the solid line shows it deflated.

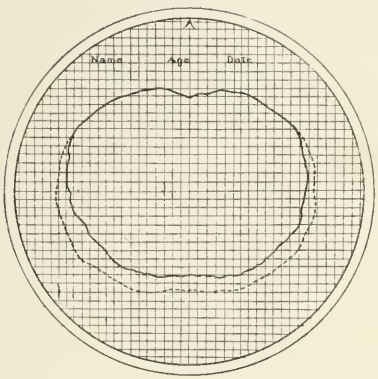
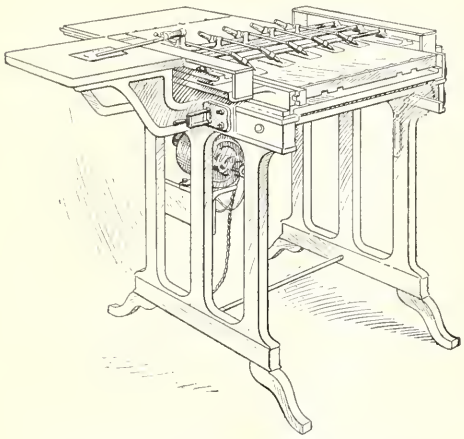


Diagram Showing Chest Inflated and Deflated

¶Servian merchants in Belgrade contemplate the establishment of an American commercial museum and show room in their city.

SIGNING CHECKS BY PANTOGRAPH

The average man, even in business, is not overburdened with physical labor due to the necessity of spending hours



The Making of One Signature Writes Twenty

in signing checks and bonds, but the heads of big organizations, such as corporations, must spend a large part of several days at certain periods writing their names over and over again. Consequently, to make this work of high officials less arduous, a pantograph machine by which the movement of writing one signature writes as many as 20 has been devised.

The user of the machine takes the "master pen" of the mechanism in his hand and goes through the motion of writing his signature. Attached to this pen is a light aluminum frame, moving almost without friction on roller bearings, secured to which are from 10 to 20 pens, at measured distances apart. Every motion of the master pen is thus exactly duplicated by each of the pens attached to the frame. These pens are of the fountain type.

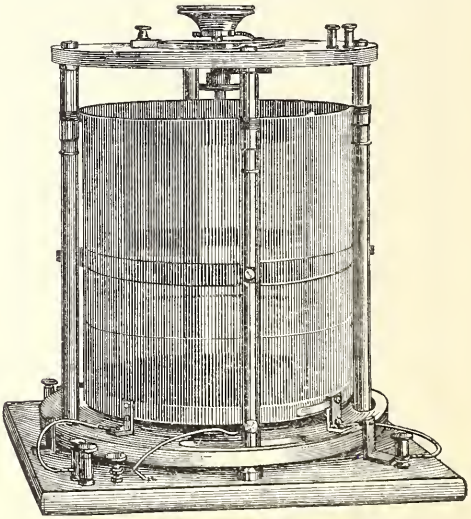
In signing checks, time is still further saved by making the writing surface a magazine of checks, and by placing it on rollers. The rolling table thus formed has receptacles for four piles of sheets, each sheet containing five checks. A motor underneath the table, controlled by pushing a button, and a spring arrangement, are utilized for working the piles of sheets into proper position for signature.

SOURCE OF WIRELESS WAVES SHOWN BY NEW COMPASS

Italian scientists have invented a curious compass, actuated by Hertzian waves, by which the captain of a ship provided with it can determine, rapidly and simply, the direction of the station sending forth a message.

Until this instrument appeared there was no way by which the officers of one ship could tell the location of another ship sending out signals, unless the distress messages gave longitude and latitude, or by which the captain could find out by wireless the exact position of his ship when approaching harbor in a fog. Had such an instrument been in service when the transatlantic liner "Republic" met with disaster, the vessels answering the wireless calls for help could have steamed rapidly to the exact spot instead of having to search for hours in the dense fog.

In operation, the indicator of the



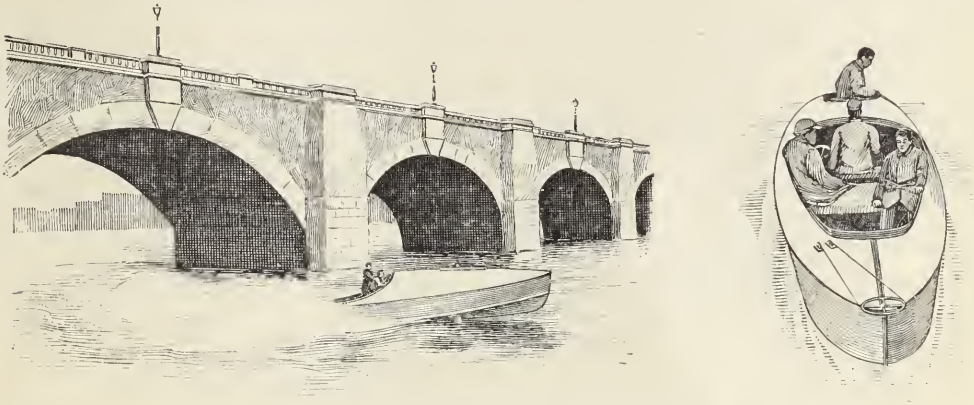
Compass that Responds to Wireless Waves

compass points directly to the source from which the wireless message is sent, so that, if the signals are kept up, all that is necessary is to steer the

searching ship in the direction to which the indicator points.

SKIMMING MOTORBOAT MAKES 40 MILES AN HOUR

Although only 26 ft. long, this curious motorboat is equipped with an engine developing 120 hp., and can attain a speed of slightly more than 40 miles an hour. The reason of this great speed is the shape of the hull, which gives her an action like that of a hydroplane, although having no plane, she cannot be called one.



Skimming Motorboat in Action and at Rest

When not running, the queer craft looks very much like an ordinary motorboat, but at full speed the greater part of the forward end rises out of the water, and she is supported by a short strip nearly amidship and possibly by another area near the stern. The inventor, however, believes that at some speeds the contact at the stern is almost negligible, just steadying instead of supporting her. Between these areas of contact, the lines of the hull are made very hollow. At full speed the water does not touch the bottom in the hollow, evidence of which fact is positively provided by means of a hole. At high speeds this hole is unplugged, and no water comes in, although it can be seen, apparently an inch or so below the boat, flying backward at 40 miles an hour.

Almost all high-speed motorboats are wet. That is, considerable water comes aboard, but this boat is dry, the reason lying in the use of sharp angles instead of round surfaces. The water is thrown directly away from the hull instead of following it around. At the highest speed, two huge volumes of water are thrown to each side.

Unlike the regulation hydroplane, this type of boat is quite seaworthy, combining and even adding to the speed of the former with the staunchness of the latter.

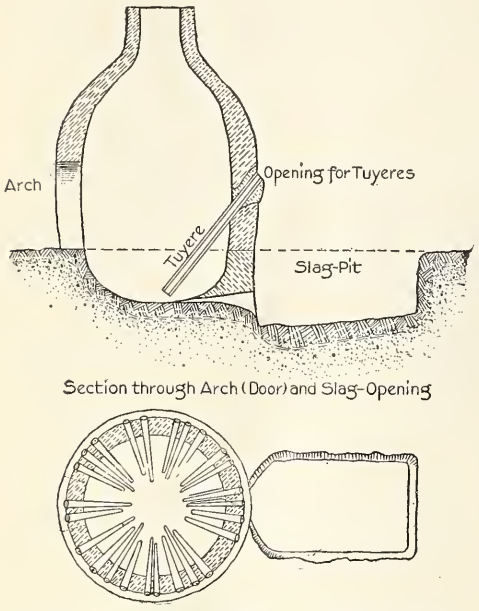
UNITED STATES HAS LARGEST REFRACTING TELESCOPE

The great refracting telescope erected in the open air at the Treptow observatory, near Berlin, to popularize the science of the heavens, is claimed to be the largest refracting telescope in the world, but this is a mistake. The largest is the magnificent equatorial refractor of the Yerkes Observatory, near Lake Geneva, Wis., although its length is only 62 ft., while that of the German instrument is 70 ft. The lens of the Yerkes telescope, however, is 40 in. in diameter, as compared to the 27-in. diameter of the German lens. The diameter of the glass or mirror is the deciding factor in estimating the size of a telescope.

¶Owing to the excessive humidity on the Canal Zone, good housekeepers burn an incandescent lamp inside their pianos at all times to prevent the wires from rusting.

NATIVE IRON SMELTING IN GUINEA

An English mining engineer, while traveling in Upper Guinea, West Africa, found in a small village called Bobela three native iron furnaces of a



Native African Furnace—Sectional Plan Showing Arrangement of Tuyeres

type never before recorded. Two of the furnaces were in operation, and one was cold, the iron having been removed and lying outside. Further on, between the Niger and Senegal basins, hundreds of slag heaps and abandoned furnaces were found, dotted over the country in all sorts of positions, some beside villages, and many in remote parts of the bush, but none of them in operation. Inquiry among white people in the locality discovered no one who had ever seen one of the furnaces actually at work.

Because the method of iron smelting adopted by these natives is one of which no record appears to exist, and because it differs radically from any other native method, a description of the furnace and its operation is of considerable interest.

The furnaces, according to a paper presented before the British Institution of Mining and Metallurgy by J. Morrow Campbell, are circular in section, about 5 ft. in external and 3 ft. 6 in. in internal diameter. The earth is scooped out of the inner circle to form a hollow hearth about 18 in. deep in the center. A narrow trench leads from this into a slag pit. The walls are built of stiff, wet, yellow clay, and are from 9 in. to 1 ft. thick at the base, diminishing to about 6 in. or less at the top. When the walls have reached a height of 18 in., about a dozen irregular elliptical holes about 1 ft. long by over 6 in. high are left at frequent intervals. A number of open pipes or tuyeres, made of a mixture of sand and clay and thoroughly dried in the sun, are inserted in these holes, some of the furnaces having as many as 26 of them.

In operation, combustible matter is placed on the hearth, and upon this, charcoal. The archway shown on the opposite side from the slag pit in one of the drawings is then built up with clay and stones, and the slag trench blocked. The next move is to fill the furnace to the top with a mixture of iron ore and charcoal, after which the charge is fired by the introduction of live charcoal through the tuyeres. Air passes down the tuyeres, and the products of combustion escape from the top of the furnace. Slag is drawn off from time to time as may be necessary. In six or eight hours the charge has run down, and then the furnace is again filled to the top with a mixture of ore and charcoal, and the process is repeated through the total run of about 30 hours.

At the end of the run, all slag is drawn off, the archway is broken down, and the mass of reduced iron, amounting to from 200 to 300 lb. in weight, is dragged out of the aperture and cooled with water. It is a spongy mass of steely iron, including considerable quantities of slag and charcoal. It is never really molten, having only reached a pasty condition in the furnace. The furnace serves for several

runs, but new tuyeres have to be inserted at the commencement of each run.

It seems extraordinary to the engineer who studied the furnaces that such structures, under 6 ft. high, could reach a sufficiently high temperature for the smelting of iron without artificial blast. On consideration, however, he finds it not quite so surprising, as the air supply, before it reaches the point where the oxygen enters combustion, is at a high temperature, owing to its having passed through red-hot tuyeres, thus providing a crude but effective form of hot blast.

PISTON-OPERATED VACUUM CLEANER

A small vacuum cleaner, operated with a piston, like a bicycle or bilge pump, has been placed on the market by a British firm. One of the features of the apparatus is that no energy is wasted, dust being extracted on both the up and down stroke of the piston. The small size of the apparatus and its low price, are also important features. The simplest way of working the machine is to hold the handle still against the body, and to move the tube quickly backwards and forwards over the surface.

TELEPHONE CONNECTION FOR OFFICIAL CARS

The moment one of the private cars of officials of the Lehigh Valley system comes to a stop on a siding or in a yard for a more or less prolonged period, the crew removes a long pole from its place underneath the car and hooks it to the nearest railway telephone line. This pole, with its reel of wire, makes a telephone connection between the car and the railway system so that the officials can transact business without the necessity of leaving their traveling offices.

The Lehigh Valley system is said to

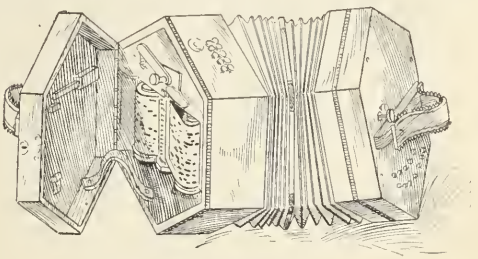
Official Car with Telephone Connection

be the first to equip its officials' cars in this manner.

SELF-PLAYING ACCORDEON

The piano-player has become an accepted innovation, and is now so common as to call forth little comment, but the adaptation of the self-playing principle to accordeons seems rather "freakish." It has been done, however, and the concern turning out the machines is finding sales.

It is suggested that the instrument, in the possession of a blind or otherwise physically incapacitated person, would

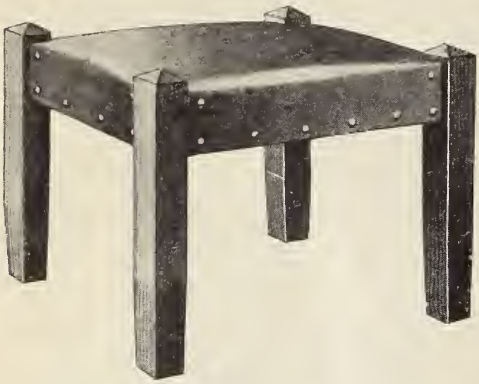


Automatic Accordeon

bring in more nickels and pennies from a street crowd than the same kind of instrument indifferently played by hand.

A MISSION FOOT-STOOL

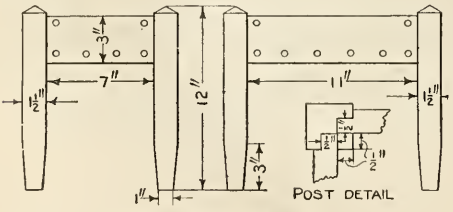
The illustration shows a very handy foot-stool in mission style. The following list of materials will be needed:



Mission Foot-Stool Complete

4 oak posts, 1½ by 1½ by 12 in., S-4-S.
2 sides, ¾ by 3 by 12 in., soft wood.
2 ends, ¾ by 3 by 8 in., soft wood.
1 bottom, ¾ by 8 by 12 in., soft wood.
1 small box of 8 oz. tacks.
2½ doz. ornamental head nails.
1 piece of dark leather, 16 by 20 in.
½ lb. hair and a small portion of mission stain.

The posts are the only parts made of quarter-sawed oak, the other parts, being covered with leather, can be made of any kind of soft wood. Chamfer the top end of each post, and taper the lower ends as shown in detail. When this is done the mortises can be cut for the sides as shown in the post detail. When cutting the mortises and tenons take care to make them fit perfectly, as there is nothing to brace the legs at the bottom. The strength of the stool depends upon the joints. Make the surface of the posts smooth by first using No. 1 sandpaper, then finishing with No. 00.



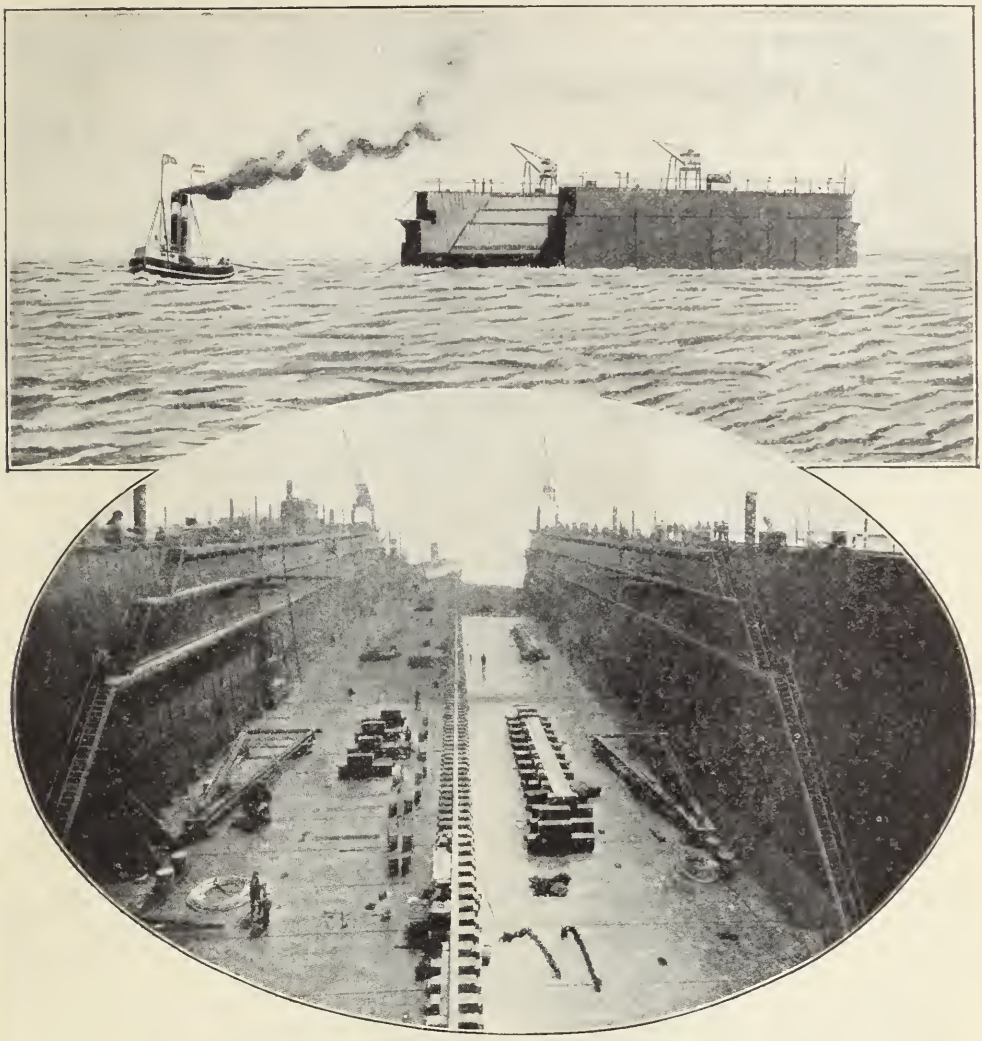
Details of Foot-Stool

The parts are now assembled. First clamp the ends together, using plenty of glue on the joints, and drive some small nails on the inside of the posts through the tenon ends. When the glue has set, the remaining sides can be put together the same as the ends. Fit the bottom on the inside about 1 in. from the top. This can be made fast by driving nails through the sides and ends of the board. The finishing is done by putting on the mission stain as the directions state on the can, then wax the surface to get a dull gloss.

The leather is now put on. Notch out the corners to fit around the posts, but do not cut the ends off. Lap them under the cover. Before nailing on the cover fix the hair evenly over the top, about 6 in. deep. Draw the leather over the hair and fasten the edges with the 8-oz. tacks. The ornamental nails are driven in last, as shown in the drawing, to make a good appearance.

PUBLIC HYGIENE TAUGHT AT FIVE-CENT SHOWS

The moving picture theater as a valuable medium of publicity is now recognized throughout the country. Organizations and institutions engaged in hygienic and sanitary reforms are spending much money for the production of films and slides to show the disastrous effects of certain agencies for the spread of infectious diseases. The first instance of the adoption of the motion pictures for use in a purely local crusade occurred in Buffalo, N. Y., when the commissioner of health secured the co-operation of several five-cent theaters in his campaign against an epidemic of whooping cough. In this connection, pictures were not used but, between films, slides were placed before the audiences which called attention to the prevalence of the disease and requested co-operation in combating it. Brief directions as to treatment and preventive measures were given. A feature of the work was the hearty co-operation with the city authorities by the proprietors of the theaters.



Starting Out to Sea—Interior of 22,000-Ton Floating Dock

BRAZIL'S 22,000-TON FLOATING DRYDOCK

The great 22,000-ton floating drydock, recently completed in England and started across the ocean to Rio de Janeiro, gives Brazil one of the first docks of this type especially constructed for the accommodation of "Dreadnoughts," three of which type of battleships, said to be as powerful as any in the world yet built, were ordered by this South American republic.

The great dock is capable of lifting and carrying a vessel of a displacement of 19,250 tons. Its length is 550 ft. over all, and its width 136 ft. It consists of a pontoon, or lifting portion, provided with two parallel side walls. The illustrations show the dock being towed out to sea on its long journey across the Atlantic, and a view of the interior lengthwise.

The advent of the Dreadnought and Super-Dreadnought types of battleship

has made necessary the construction of larger stationary and floating drydocks in all parts of the world. The Brazilian floating dock is surpassed in size by the 35,000-ton dock built at Hamburg, which soon will be surpassed by a 40,000-ton dock now building at Kiel.

STREAM OF WATER CONDUCTS ELECTRICITY

A Chicago fireman recently had an interesting experience with a stream of water and an electrically-charged rail. Standing on the water-soaked wooden planking of an elevated railway structure, he was directing a stream of water against a fire enveloping the 600-volt third rail. While the stream was being played upon it, he felt no shock, but just as the stream fell short of the rail following the order to shut off the water he received a shock which almost threw him from the platform.

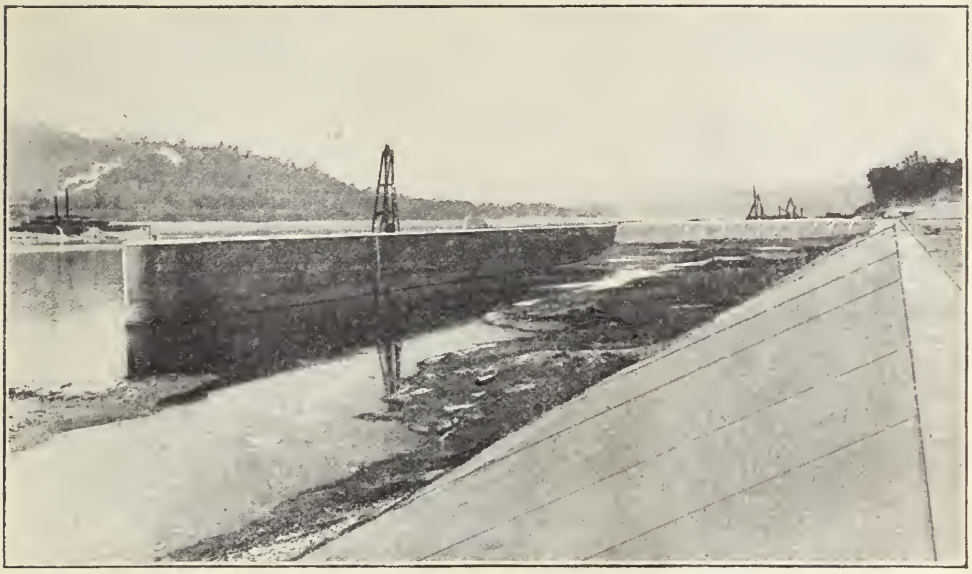
During the time he was directing the stream on the rail, the platform on which he was standing was doubtlessly charged with electricity from the damaged insulators supporting the third rail, but it is believed that the small current which flowed over the moving stream and the hose to the ground kept the nozzle at a potential so near to that of the charged platform that he felt nothing. When the connection through the stream was interrupted, however, he received the full effect of the difference in potential between the charged planking on which he was standing and the ground provided by the water in the hose line.

ICE HARBOR IN OHIO RIVER TO PROTECT CRAFT

In connection with the million-dollar dam that has been constructed in the Ohio river, 12 miles below Cincinnati, the United States government has built an ice harbor in which the river craft may take refuge in the winter and early spring from the masses of floating ice that has caused millions of dollars worth of damage in past years.

The harbor is solid concrete, re-inforced with steel, and is the first to be built in the Ohio. It is large enough to afford ample protection against ice runs to all the craft in its vicinity. It

Ice Gorge in the Ohio River at Cincinnati—These Conditions Have Caused Much Damage in the Past



The New Ice Harbor Built by the Federal Government—Vessels May Take Refuge in the Inclosure

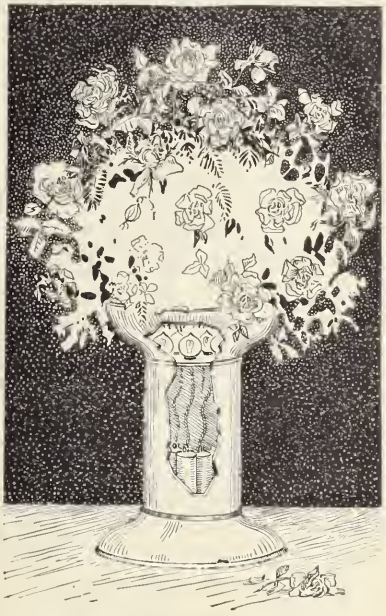
has happened frequently that the entire river would be filled in the early spring with huge cakes of floating ice that crush and grind even vessels of the largest type.

In the summer, the new harbor can be used as a repair dock. It is stated that similar structures will be provided at the other dams to be built in the Ohio.

ILLUMINATED FLOWER CLUSTERS

The tungsten filament has made possible new and artistic electric table-lighting effects without the necessity of running wires up under the table or dropping them from the ceiling to provide the current. Instead, the new table pieces are self-contained, being provided with a single-storage cell capable of supplying current for three tugnsten lamps for 14 hours.

The table piece shown in the illustration consists of a silver receptacle containing the storage cell and three tungsten lamps, over the top of which is set a shallow glass dish containing water and cut flowers. The flowers are held in position by a glass disk provided with perforations through which the stems are inserted. The illumination, passing through the glass and

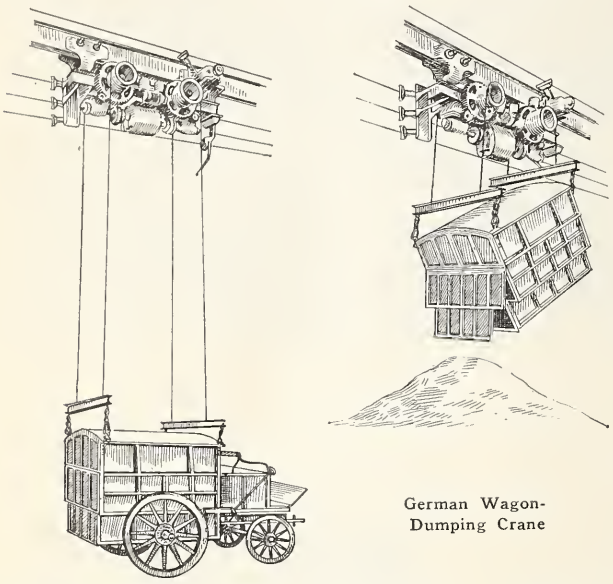


Illuminated Flowers for Dinner Table

water, and diffusing itself around the flowers and leaves, produces a beautiful effect.

OXY-ACETYLENE TORCH CUTS WAY THROUGH VAULT

An oxy-acetylene torch was used recently to cut away a section of the wall of a bank vault in Springfield, Mass. The vault armor consisted of 60-lb. rails, dovetailed into each other, and bars of three-ply chrome steel between the rails, the whole being set in cement. The total cutting was 30 ft., and the thickness of the wall was 5½ ft. The cement between the rails complicated the work, and it was necessary to chip it away as the cutting progressed.



German Wagon-Dumping Crane

¶After careful investigation of the subject the experts of the Department of Agriculture at Washington state that rubber cannot be produced in commercial quantities in the United States proper. Great progress is being made with the industry in the Philippine Islands, however, where it was taken up but a few years ago.

¶The atmospheric conditions in the Argentine Republic are so favorable for wireless telegraphy that the postmaster general of that country proposes its substitution for the present telegraph system.

UNLOADING REFUSE WITH ELECTRIC CRANE

The refuse-gathering wagons of one of the German cities are designed to be unloaded by electric cranes. The bodies are made detachable from the four-wheeled trucks, have a swinging or drop door at the back, and are provided with strong eye-bolts for the attachment of the pairs of hooks suspended from an electric traveling crane. The two pairs of hooks and lifting cables are operated by the one motor, but the forward cables are wound on a larger drum than those attached to the rear of the wagon, so that the front of the wagon rises faster than the rear.

TELEPHONE LINES FOR FREIGHT TRAINS

The telephone as a means of transmitting orders from the rear ends of long freight trains to the locomotives drawing them was recently given a test on an exceptionally long coal train. The train in question was composed of 123 cars loaded with coal. It was drawn by two locomotives from the Indiana coal fields to Mattoon, Ill., the movement of the train being directed by telephonic orders given by the conductor in the caboose at the rear. The wires were strung over the cars from the caboose to the locomotives.

OHIO TOWN HAS UNIQUE PUBLIC COMPANY

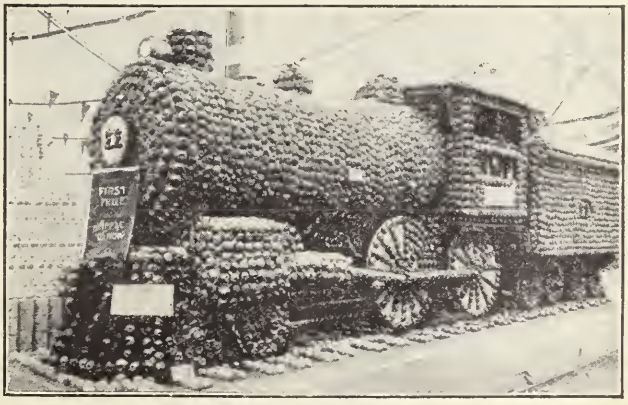
The little town of Loveland, Ohio, with a population of about 3,000, is successfully operating a system of public utilities that might well make a city, several times its size, proud. Loveland is situated on the Little Miami River, 23 miles from Cincinnati, and its public service company runs a combination

electric power and light, water and ice plant. The four enterprises are conducted by one chief officer with a single force of assistants, and it is the economical combination of the three that makes each a success.

The water is obtained from a deep well on an island 2,600 ft. from the station, and is conveyed to a storage tank of 45,000-gal. capacity, located under the large pumps at the station. Every user of steam engines in Loveland has been induced to adopt electric power, and an all-day and all-night electric service is provided. The ice plant, which uses power from the power plant, thus rendering both economical in the running, takes care of approximately 20,000 cu. ft. of refrigeration, besides manufacturing 15 tons of ice daily. The success of the ice plant is mainly due to the storage of large quantities of ice. Thus it can be operated continuously instead of only a few days at a time or a few hours each day. Over the ice storage rooms proper are rooms for the storage of fruit, meat, eggs and other perishable goods.

LOCOMOTIVE BUILT OF APPLES

The prize-winning exhibit at a horticultural exposition recently held at Sebastopol, Cal., was the apple locomotive here illustrated. Standing on an apple track, which in turn rested on apple ties, the unique locomotive, made of several thousand specially selected apples, was easily the most popular set-piece provided for the entertainment of the spectators.

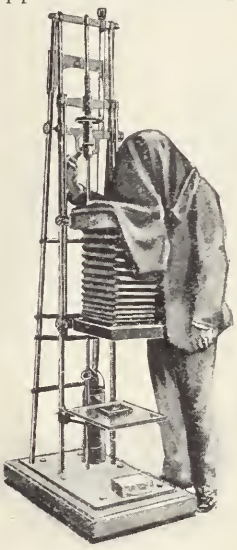


An Edible Locomotive

The framework holding the apples was 26 ft. long and 9 ft. high. Very few details were omitted, the completed piece including the cow-catcher, headlight, stack, bell, whistle, sand-chamber, cab, tender, etc.

VERTICAL PHOTOGRAPHIC APPARATUS

Included among the new photographic apparatus installed in the

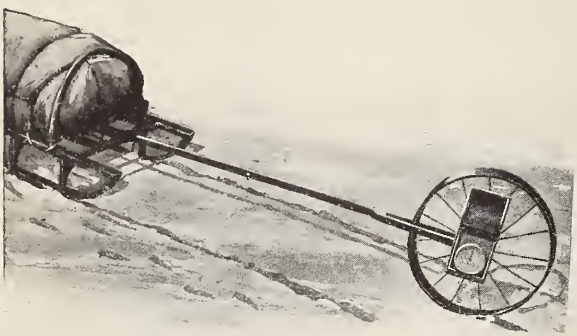


Vertical Camera Used in French School of Mines

French School of Mines, Paris, is a vertical camera for the convenient reproduction of both transparent and opaque objects. The camera is fastened to two vertical rods sliding on two fixed posts, and is balanced by a counterpoise attached to a cord passing over a pulley. Object holder is adjustably attached to the posts and focusing is effected by moving either camera or holder.

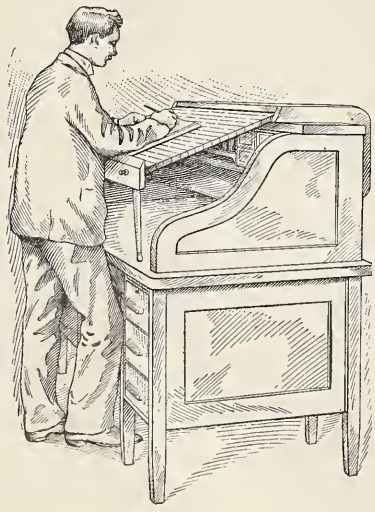
ROLL-TOP DESK CONVERTED INTO STANDING DESK

An attachment designed for converting a roll-top desk into a combined office and bookkeeper's desk is here illustrated. It also gives additional working space when the main writing surface is covered up with documents.



A Polar Speedometer

The attachment consists of a casing secured to the top of the roll-top desk and provided with a flexible leaf, which may be pulled out in front to form a rigid writing surface at the height of the ordinary standing desk.



Extra Writing Surface Attachment for Ordinary Desk

SPEEDOMETERS WILL RECORD DASH TO SOUTH POLE

Captain Scott's dash to the South Pole is to be the first polar expedition in which the actual distance of the journey traveled by the sledges will be measured by mechanical means. Only a couple of weeks before the sailing of the "Terra Nova," Captain Scott decided that mileage recorders, especially constructed for polar conditions, could be used to considerable advantage.

Consequently, the recorder here illustrated was devised. The recording meter is attached to a trailer wheel, which is lashed to the back of the sledge. The wheel is provided with short spikes, and all the metal parts are of aluminum. Seven of the instruments were taken by the expedition.

CLAM-GATHERING WITH MOTORBOATS.

Scattered along the Mississippi River and its many tributaries are hundreds of river dwellers who make a comfortable living gathering clams, and lead a care-free, easy-going life. Their regular income is derived from the sale of shells to button factories, the price received being from $15 to $20 a ton. Then there is also the possibility of finding valuable pearls, which lends fascination to the work.

The usual method of gathering the clams is dragging grapnels along the bottom of the river from a motor scow. This motor-driven scow is about 20 ft. long, and 4 ft. wide. Uprights at each side and end support the gas piping to which the grapnels are fastened. The grapnels, made of wire, are hung three or four in a string at intervals about 4 in. apart on the pipe or piece of tubing.

When the desired spot is reached,

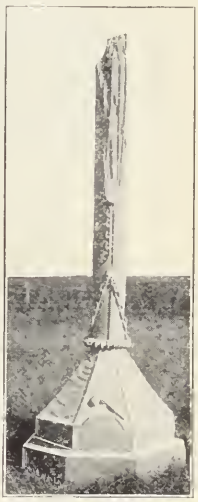
one of the pipes, with its battery of grapnels, is dropped overboard and allowed to drag behind for about ten minutes. The boat is then stopped, the catch hauled in, and the second outfit dropped overboard. The grapnels, dragging along the bottom in water anywhere from 6 to 12 ft. deep, strike the clams, which close their shells upon the wire and hang on with a tenacious grip. Less than 40 clams at a haul is considered a small catch.

After the catch, the clams, which are usually larger than the palm of the hand, are dumped into zinc-lined wooden boxes built over brick fireplaces at the edge of the river bank, and steamed. This steaming makes the opening and cleaning of the shells simple. The meat is thrown into a box, where it undergoes a thorough sorting and squeezing in the search for pearls. Nearly all the pearls are marketable, and some have even been worth several hundred dollars.

On the stretch of water known as Peoria Lake, a wide part of the Illinois River, about 18 miles long, the clamming fleet includes more than 150 motor-propelled craft.

CIRCUS MEN'S MEMORIAL TELLS THE STORY

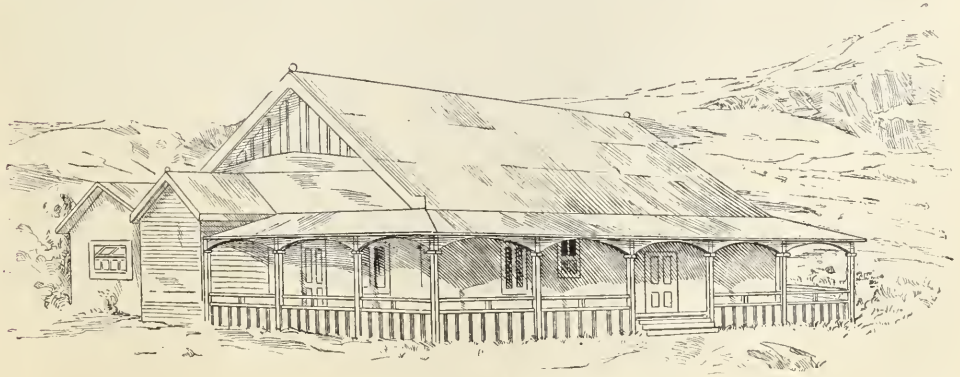
While a large circus was exhibiting at Wahpeton, North Dakota, lightning struck and shattered one of the tent poles, killing two of the employes. They were buried in the Wahpeton cemetery, and over them was erected a monument representing a shattered tent pole.



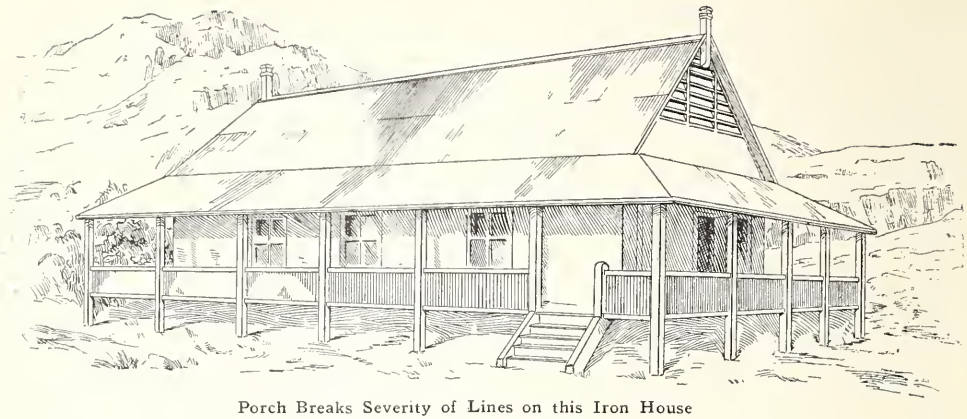
¶The Mutes' World's Convention at Colorado Springs authorized the creation of a fund to provide educational and religious instruction and entertainment by printing lectures by eminent men on moving-picture films and sending them around among the deaf mutes of the country.

ARTISTIC PORTABLE METAL HOUSES

The first portable metal houses placed on the market were mere boxes, provided with a gabled roof and partitioned into stall-like rooms. Such houses, as hideous in appearance as an ordinary shed, have now given way to the demand for more artistic and pretentious designs, and as a result it is



A Handsome Metal House



Porch Breaks Severity of Lines on this Iron House

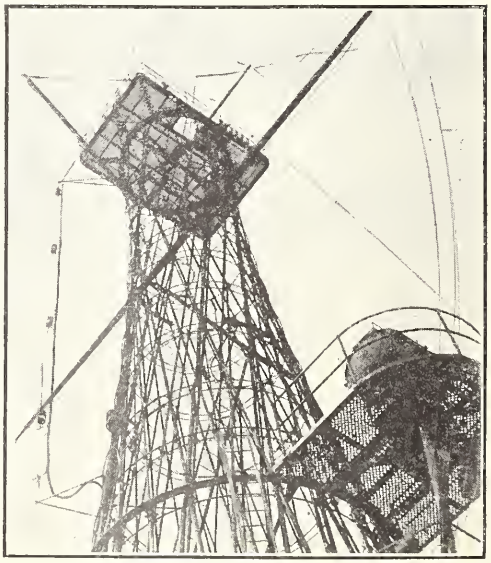
now possible to purchase a metal house of considerable architectural merit as well as features of convenience.

The two houses here illustrated are fair examples, the box effect being broken by well proportioned porches.

SIGNALING DEVICES ON U. S. BATTLESHIPS

By WALDON FAWCETT

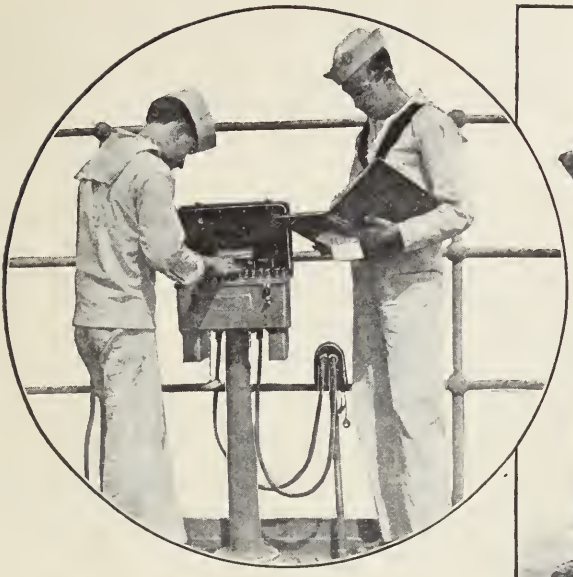
The whole current history of the United States navy shows a continual quest for new equipment designed to promote in one way or another the efficiency of our floating fortresses. In no sphere, however, has study and experiment brought a higher degree of perfection than in the facilities for signaling. Under present conditions when our battleships operate almost wholly in fleet formation, it is more essential than ever before that each ship shall be enabled to communicate promptly and accurately with the flagship or any other vessel in the division or fleet, or with the shore. With the twentieth century precautions against all contingencies in time of battle, it is the aim to provide enough and diversified systems of signaling so that if one or two be put out of commission, there will yet remain others to make communication by day or night possible.



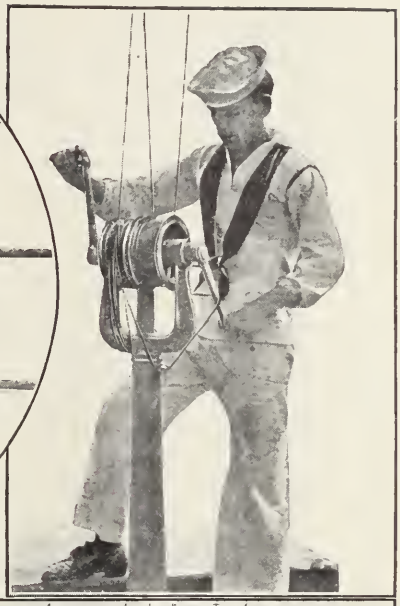
ARDOIS SIGNALS SUSPENDED FROM MAST

Controlled and manipulated by means of a keyboard located on the bridge of the battleship. This keyboard is operated much after the fashion of a typewriter keyboard.

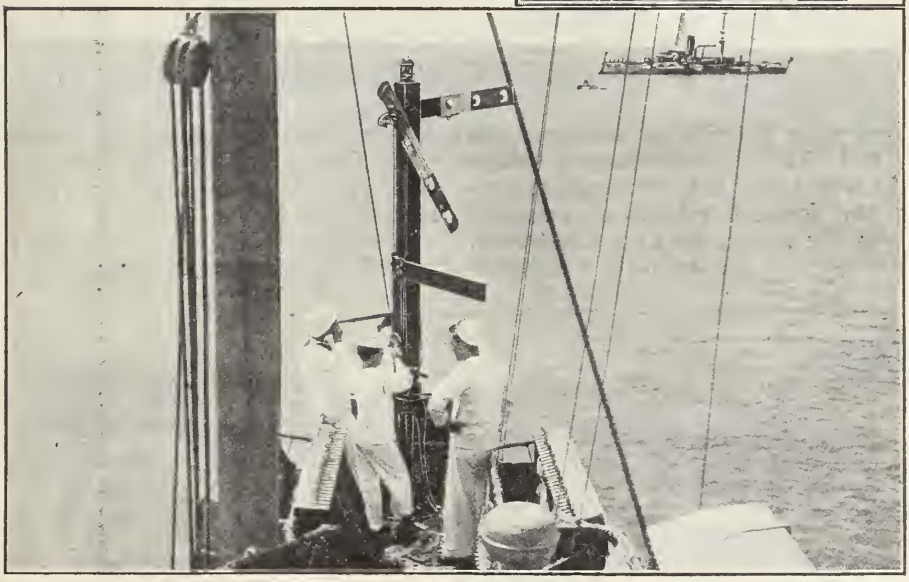
The wireless telegraph has paved the way for a new era in communication between warships at sea, although, unfortunately, the wireless telephone has not yet been perfected sufficiently to fulfill all naval needs. For daylight signaling on the warships, there is yet



Operating the Ardois System of Signaling



New Device for Controlling Searchlight Signals



Semaphore Signaling on U. S. S. "Minnesota"

extensive dependency upon the manipulation of signal flags from the truck and the familiar "wig-wag" signaling by means of small flags waved by hand. Both of these are, of course, daylight systems but the "wig-wag" system may be converted to a night system by the substitution of an "electric torch" for the small signal flag.

The main dependency for night signaling, however, falls upon the Ardois system which consists of a cluster of red and white lights (incandescent lamps) the various combinations of

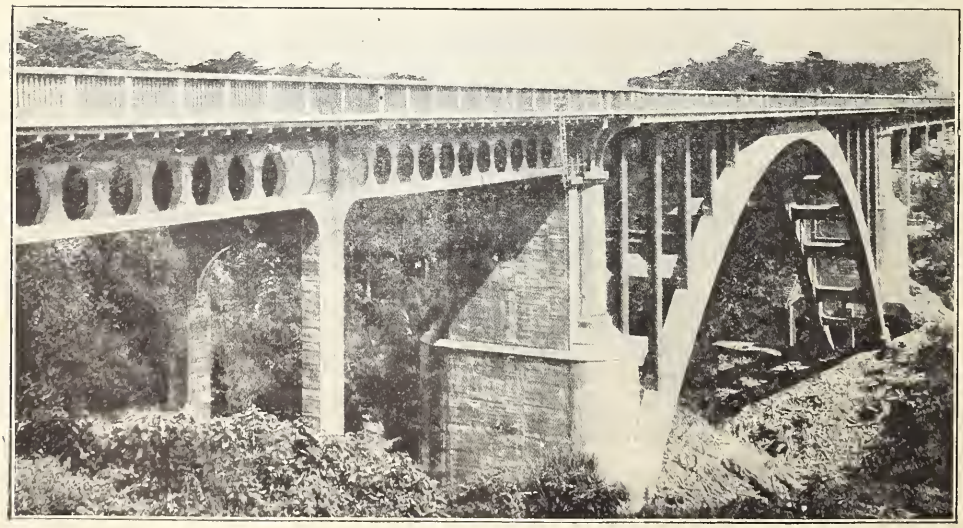
which, signifying the respective figures and letters of the alphabet, are controlled and manipulated with almost incredible rapidity by means of a keyboard located on the bridge of the battleship and operated much after the fashion of a typewriter keyboard. The semaphore system is available for use both during the day and at night. The wooden arms, which by their different positions convey word by word any signal message are, of course, readily discernable during the daylight hours and at night they are outlined in electric lights which render them no less conspicuous.

One of the newest "wrinkles" in our navy is the increasing use of the powerful searchlights for signaling purposes, particularly in time of fog. The searchlights are employed for signaling not only at night but in the daytime as well, and they have conveyed messages a distance of more than eight miles. In order to promote the searchlight signaling, the old-time method of manipulating the lights by hand power has been entirely done away with. Under the new regime there are no men stationed on the searchlight platforms to turn the big lights this way and that by sheer force. Instead, the searchlights are now manipulated by electrical or mechanical means, and the control of each light is in the hands of a man who can remain in a sheltered position behind the conning tower or at the base of the fire control tower and who has at hand apparatus which insures the prompt response by the searchlight to every command involving a change in the direction of the finger of light or the formulation of a new signaling combination.

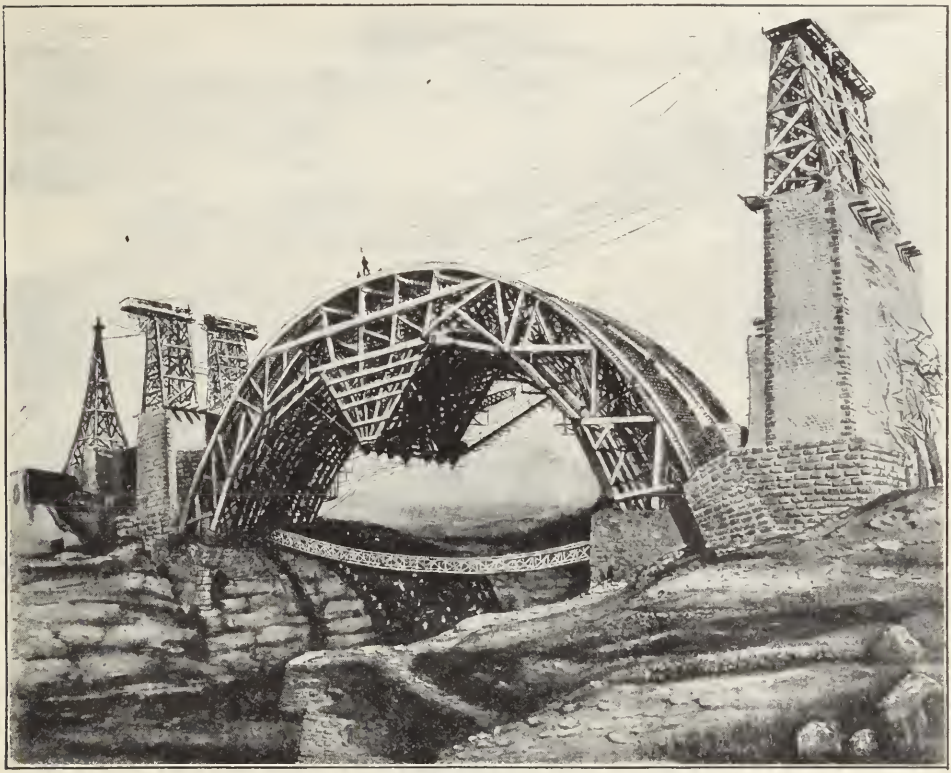
TWO INTERESTING FOREIGN BRIDGES

Two very interesting bridges, one said to be the highest masonry bridge in the world, and the other said to contain the longest reinforced concrete arch in the world, are here illustrated. The latter was but recently completed across Cemetery Gully, in Auckland, New Zealand. The central portion of this bridge is a reinforced concrete arch span of 320 ft.

The other bridge, of masonry construction, crosses the gorge of the



Long Concrete Arch Span in Auckland



High Masonry Bridge While in Course of Construction

Rhumel River at Constantine, Algeria. The viaduct is 1,475 ft. long, and has 27 arches of unequal dimensions. The arch shown in the illustration is the largest of these, 230 ft., and crosses the gorge 330 ft. above the bed of the river.

The Aviator

By CHARLTON L. EDHOLM

HE ranges new dominions
On silken, sun-kissed wings,
The flutt'ring engine sings;
He mounts on tireless pinions.

From cloud to cloud ascending
He soars in golden light,
While yet below is night,
A night that seems unending.

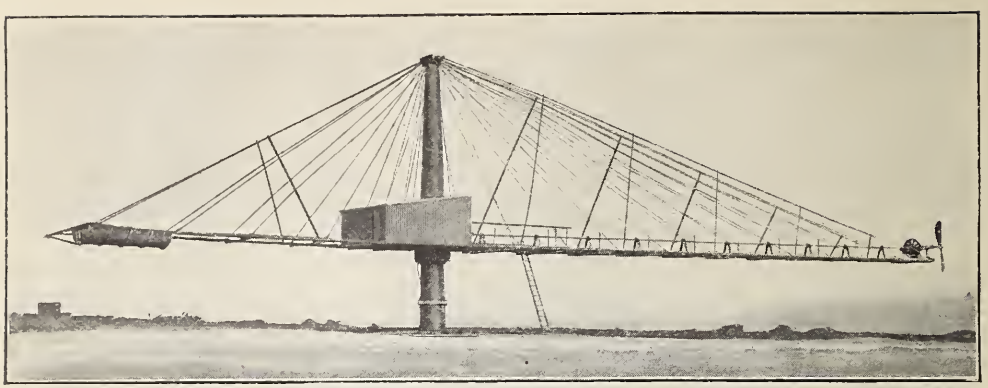
Upon the wings of morning
He sees on twilit earth
Afar the New Day's birth,
Its promise and its warning.

The dove o'er floods returning
Was watched, as we watch now,
For spray of olive bough;
Hark, all mankind is yearning:

"What bring you, navigator,
From shoreless seas of air,
What token do you bear,
What message, aviator?

"Bright wings, come you with blessing
Or fraught with death and woe,
The harried race below
With new, red fears oppressing?"

No answer. Just the singing
Of engines. That is all.
While earth-bound gropers call,
Dumb Fate o'erhead goes winging.



Tests the Power of Airship Propellers

AIR PROPELLER TESTING PLANT

By JOHN R. MAIDENS

Elaborate machinery has been installed at the Vickers' Sons and Maxim's Works, Barrow-in-Furness, England, for testing the efficiency of airship and aeroplane propellers. The apparatus consists of a steel cantilever, accurately balanced and suspended in such a manner that it is free to revolve on the head of a cast-iron column.

The point to which the suspension rods converge is a steel bracket to which is fastened a steel tube. At the head of this tube there is a ball bearing which supports the entire weight of the moving portion of the structure. The arm proper is built up of steel angles, and is provided with a covered observation station at the center, which contains a 100-hp. motor and the recording instruments. Although this motor is nominally 100 hp., it is capable of testing propellers absorbing up to 200 hp.

At the extreme end of the arm, and 110 ft. from the center, there is a steel platform carrying the bracket and bevel gearing for driving the propeller, the power being transmitted along the arm by steel shafting. The other end of the arm terminates in a sheet-iron ballast tank by means of which it is possible to accurately balance the whole structure.

When conducting trials, the revolutions of the propeller may be varied from 250 to over 1,000 revolutions per minute.

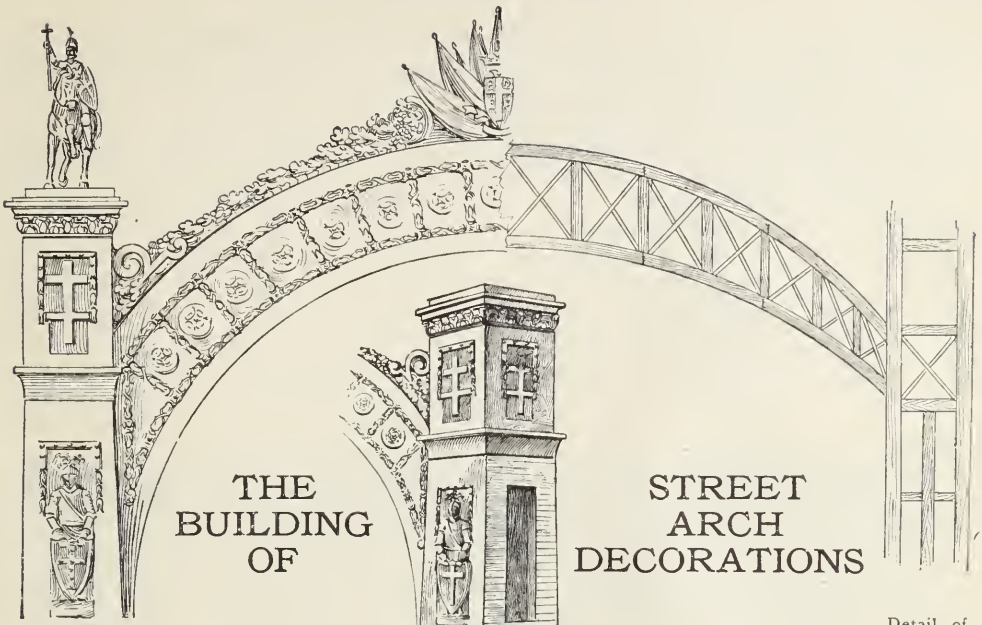
LARGEST, FASTEST, MOST POWERFUL CRUISER

The British armored cruiser "Lion," just launched, is the fastest, largest, and most powerful cruiser in the world. Her length is 700 ft., her beam, 86½ ft., and her displacement, 26,350 tons, which is greater than that of the two great battleships to be added to the American navy.

Regardless of her huge bulk, the "Lion" will have the extraordinary speed of at least 32¼ miles an hour. Her main armament will consist of eight 13½-in. guns, and the armor, which will extend from the upper deck to well below the water-line, will be 10 in. thick.

Although the "Lion" has the cruiser shape, even the British naval writers smile at the idea of calling her a cruiser. She has the armor and armament of the battleship class.

¶The Exchange Bankers' Association of the Far East is waging a campaign against the use of the typewriter for filling in particulars on bills of exchange. The association wants all such writing done by hand to avoid forgery.

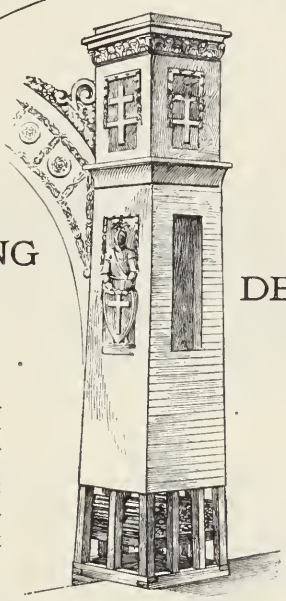


Completed Arch

THE BUILDING OF STREET ARCH DECORATIONS

Detail of Arch Frame

Street arches are becoming more popular every year in the decoration of cities on occasions of civic fêtes and general celebrations. These arches are not difficult to construct, are comparatively inexpensive, and form imposing and handsome temporary ornaments.



Base of Timbers and Ballast Platform

A quick and inexpensive method of erecting arches was used in Chicago during the Knights Templar conclave. Owing to the fact that the asphalt street paving was laid on a solid concrete sub-base, the structure could not be fastened to the ground. Each column had to be constructed in such a manner that it would support its part of the weight without being fastened with guys or anchored to the ground.

The columns were built up on a base, made of 10 by 12-in. timbers, on which 6 by 8-in. uprights were set to carry the arched framework.

A platform was built, about one foot up from the base, inside of the uprights, and on this ballast was placed to hold the entire arch solid. The ballast consisted of six tons or more of pig iron. Sand in bags would do as well, however. No bracing was required to keep the arches rigid.

In the illustration of the column, the different stages of construction are shown. The uprights were covered with sheathing, and cloth was tacked on the boards to make a smooth, white surface. Openings were left in the woodwork to make recesses for ornaments.

The arch proper consisted of two girders, made of narrow boards, latticed and braced sufficiently to carry the weight. In the second illustration, one-half of the arch is shown completed, while the latticed girders are uncovered in the other half. Boards covered the latticed work, and cloth, tacked on the boards, made the finish the same as the columns. The cloth was painted or sprayed with a plaster composition to give the whole structure the appearance of having been made of stone or plaster.

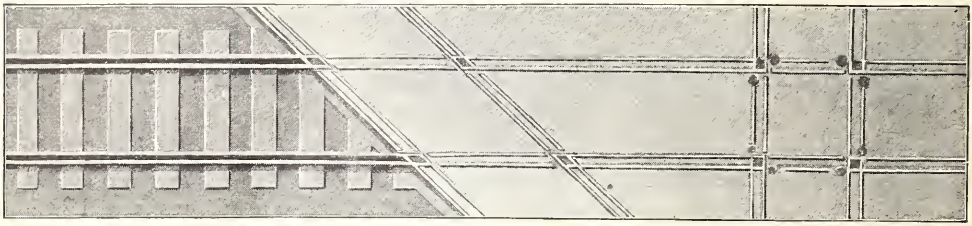
Ornamental designs were made up of plaster parts, modeled over hay and wire mesh, and attached to a light

frame of metal. The larger ornaments, such as a horseman, which were modeled by a sculptor, were built up in parts so they could be put in place piece by piece. After the parts were all in position, the joints were filled with plaster and smoothed so seams could not be detected.

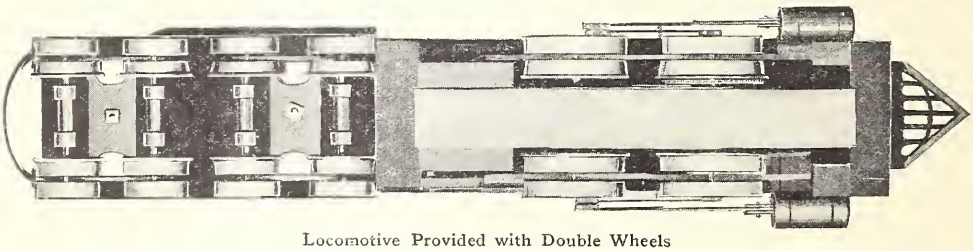
The timbers can be joined together by various methods, but as such structures are only temporary, it is best to use a joint that is quickly assembled without much work, and one that will not spoil the material for other purposes.

DAILY MOVEMENT OF THE EIFFEL TOWER

To ascertain whether the Eiffel Tower had suffered any displacement as the result of the Seine flood, an examination was ordered. It revealed the fact that the position of the top of the lightning rod, in relation to a datum, had not undergone any variation since previous examinations in 1896 and 1908, but that this point had a daily motion of from 1¼ to 7 in., varying in direction with the season and produced by the heat of the sun. It was east to west in May and August, 1896, north to south in December 1908, and east to west in June 1910. During winter, the sun only strikes the southern side of the tower while in summer it strikes all sides, producing a displacement in a general direction perpendicular to the meridian, and more complicated than during the spring and fall.



The Double Track System



Locomotive Provided with Double Wheels

DOUBLE-WHEEL SYSTEM FOR RAILWAYS

The long list of accidents, due to spreading rails and breaking wheel flanges on both electric and steam railways in this country, constitutes the reason for the new idea in railroad construction shown in the accompanying illustrations. First cost of such installation would, of course, be very large, as the system consists of double rails and double wheels.

The double-rail system consists of an ordinary standard gauge set of tracks, reinforced by a wider auxiliary track running just outside. The flanged wheels of the steam locomotive, electric car or passenger coach, would engage with the inner tracks, and the special flangeless wheels would engage with the auxiliary track.

¶Clement J. Driscoll, Commissioner of Weights and Measures of New York, declares that the citizens of New York City are robbed of $30,000,000 annually through short measure.

SHOP NOTES

Home-Made Air-Hose Connection

Those who have used compressed air on pneumatic tools will appreciate the air-hose connection shown in the illustration. The ordinary method of connecting an air hose to a pneumatic hammer or other appliance of this kind very easily loosens it from the socket by the moving of the hammer and the force of the air. In Fig. 1 is shown the ordinary connection where A is the hose; B, the grooved connection and C, the threaded end to which the hammer is fastened. Wire is wound around the hose at C.

The home-made connection is shown in Fig. 2. I used a ¼-in. nipple, A, and cut nicks on the outside, about ½ in. apart, then forced it into the hose. The nicks hold the nipple from coming out. I slit a ¾-in. nipple, C, in two and placed the two halves on the ¾-in. hose, one-half on each side. Then I cut one arm from a ¾-in. tee, B, and

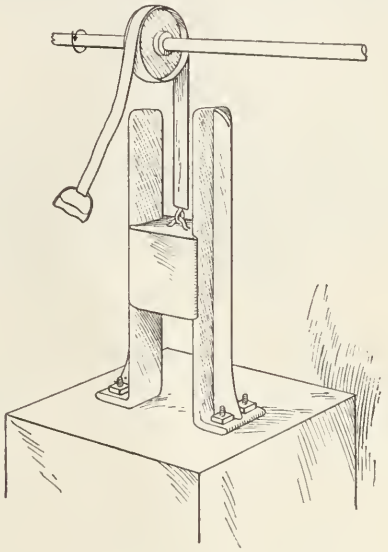
Fig. 1 Fig. 2

Connections for Air Hose

screwed it over the two halves on the hose, compressing the hose the thickness of the nipple slit, which forced the inside against the nicked part of the ¼-in. nipple and prevented it from coming out.—Contributed by Philip J. Conley, Chicago, Ill..

A Light Power Hammer

The accompanying sketch shows the construction of a power hammer for use in small shops, where the cost of an expensive machine is prohibitive. The guide and hammer are specially constructed parts. A little pull on the belt will cause enough friction to carry the hammer to the top of the guides. When released, the hammer will strike a blow proportional to its weight and

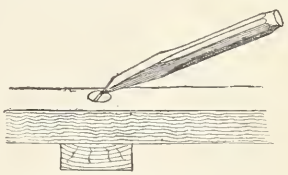


Friction of Belt Draws Hammer Up

height of drop. Different dies may be bolted to the anvil to make parts that will answer, in many ways, the same purpose as drop forgings.—Contributed by Urban A. Towle, Portland, Me.

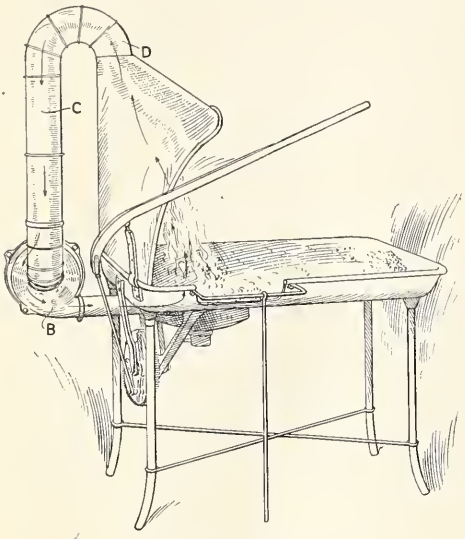
Turning a Rusty Screw

In turning a rusty wood screw, the head often becomes damaged so that the screwdriver will slip. This trouble may be overcome by putting the point of a chisel in the groove to one side of the center, as shown in the illustration, driving the chisel with a hammer and following around as the screw turns.—Contributed by W. C. Parker, Kanawha, Ia.



Burning Smoke from a Forge

Coal smoke is nothing else than unburned carbon. When great clouds of smoke go up from a forge, heat is wasted. I hit upon an idea to prevent



Smoke-Burning Forge

this waste and worked it out, as shown in the sketch, successfully.

Using a common forge with hood attached, I connected at D a tin pipe of the same size as the opening into the suction side of the blower, as shown at C. When the blower is in use, the smoke that rises from the fire passes in the direction of the arrows back through the blower and up to the fire without escaping into the open. By using this method, I have been able to get much more heat out of a given quantity of coal.—Contributed by J. N. Bagley, Webber, Kansas.

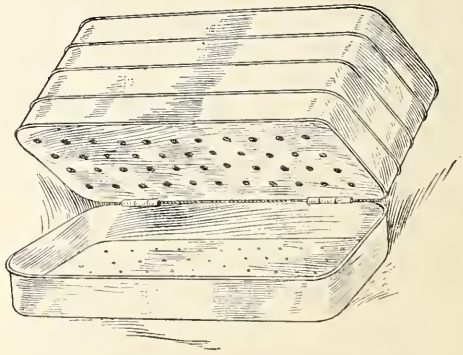
Oak Finish on Hard Pine

Owing to the scarcity and high price of oak for inside woodwork, many of the builders of moderate priced small houses are utilizing hard pine for their finishing material by using various shades of stains. This is the proper way to have a beautiful finish on hard pine and at the same time imitate oak. The proportions for the stain are: 1 part pure asphaltum; 2 parts linseed oil, 1 part turpentine. To each gallon of this, add from ¼ to ½ lb. of drop black and from ¼ to ½ oz. of burnt sienna, according to the shade desired. After thoroughly sanding, apply with a large brush and wipe dry within one minute. Allow this to stand two days.

Give the surface a coat of golden shellac cut in alcohol, to which has been added enough bismark brown to slightly color. Sandpaper and give the first coat of varnish, thinned slightly in turpentine. After from 24 to 48 hours, apply a second coat just as the varnish comes from the can. This will produce a very desirable finish much in favor.—Contributed by E. C. Andrus, Columbus, O.

Sorting Steel Balls

A number of small tin boxes having hinged covers with the cover of one box soldered to the bottom of another and each division drilled with holes of the same size, makes a convenient apparatus to quickly sort steel balls. Beginning at the top, holes which will allow all sizes of the balls except the largest ones to pass through them are drilled in the bottom of the first box; in the bottom of the next box, holes of such size that only the next smaller balls will be detained therein, and so on until



Compartments for Different Sized Balls

you have provided a box for each of the usual sizes of balls.

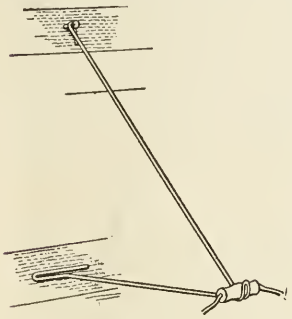
After cleaning the balls, all sizes are placed in the top box and the whole

combination shaken up. The balls will pass from box to box until they reach one with holes too small for them to pass through.

As the cover of each box is free to open, the right sized balls can be taken out without disturbing the others.—Contributed by C. G. Smith, Brooklyn, New York.

A Dairy Pail Hanger

The accompanying illustration shows a method of bending a wire so that when it is hung on a nail a pail may be suspended from the hook, keeping it clear from the wall. The bending of the wire is so clearly shown that the hanger needs no further explanation. The long bend resting against the wall at the bottom keeps the hanger from swinging around under the weight of a full pail. The base of the wire is 8 in. long and the upper part 16 in. Contributed by John A. Long, Walkerton, Canada.



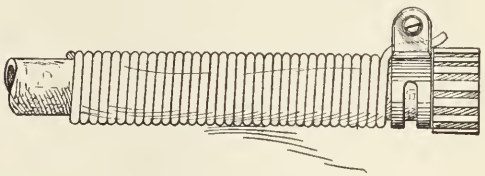
How to Draw a Wavy Line

When it is desired to draw a wavy line with the ruling pen, simply substitute the edge of a coarse-toothed comb for the straightedge. The more rapidly the pen is drawn past the teeth, the less wavy will the line be. Use a coarse comb in which the teeth are not too flexible.—Contributed by A. J. Augustine, Muskegon, Mich.

¶Should the paint on the rim of an automobile wheel be knocked off in places in removing the tire, take time to apply a good enamel to prevent the forming of rust.

Preventing Breaks in Garden Hose

Breaks in garden hose near the coupling can be prevented by removing

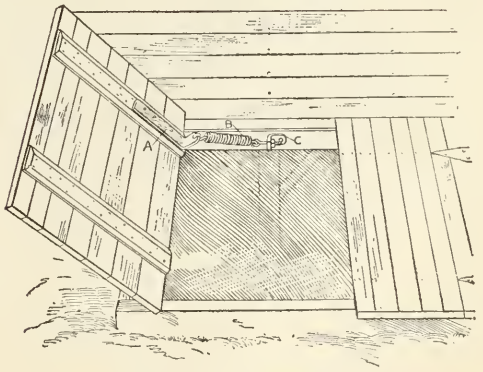


Coil Spring on a Hose

the hose and slipping a coil spring about 8 or 10 in. long over it, as shown in the illustration. The spring should fit the hose neatly. After replacing the coupling, the spring may be fastened to the band around the hose as shown.—Contributed by E. Maurice Dunivant, Fort Worth, Texas.

Counterbalance for a Cellar Door

The accompanying illustration shows a device attached to a cellar door to assist in lifting it, as well as to keep it from falling and breaking the hinges. A piece of heavy iron, A, is bent into the shape of an L and bolted to the door. The short end of A, which is 5 or 6 in. long, is attached to a coil spring, B. The other end of the spring is fastened to an L-shaped piece, C, on the joist, by a long threaded eye-bolt

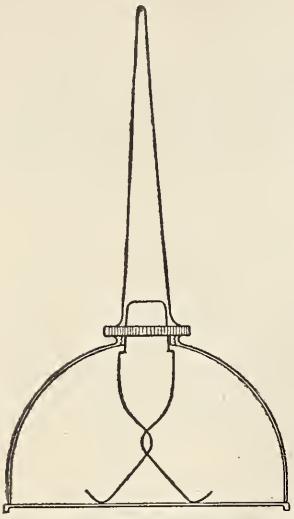


Cellar Door Counterbalance

for regulating the tension. This arrangement does away with the rope and pulley above the door.—Contributed by C. H. Floyd, Elwood, Ind.

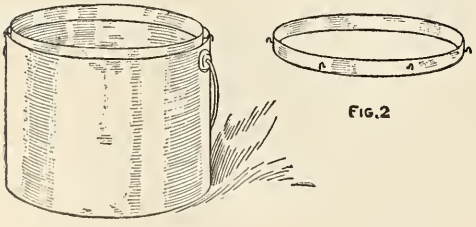
Oil Can Bottom Spring

When the spring bottom in an oil can gives out, do not throw it away. Take a piece of brass spring wire, bend it as shown in the sketch, being careful to cut it to the proper length, and place it in the can. The pressure of the spring will keep the bottom out in the original position. The spring can be made in a few minutes and will save the price of a new oil can.—Contributed by C. T. Stendahl, Center City, Minn.



Paint-Brush Drainer

In the illustration, Fig. 1 shows a paint pot with a paint-brush drainer attachment. The attachment is made as shown in Fig. 2 from a 1-in. strip of metal. The diameter of the band should be ½ in. less than the pail. Hooks are attached to the band for holding it in position on the top edge of the paint pot. The outside of the paste, glue or paint pots will always remain clean, if this attachment is used. When the brush is drawn over the band, the surplus liquid drains down into the pot instead of on the outside of the pail.—Contributed by W. A. Jaquythe, Richmond, Cal.

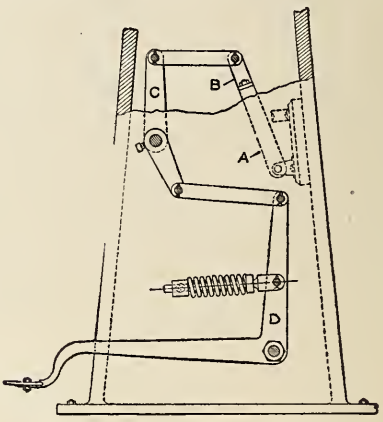


Ring Drains Paint in the Pail

Emery Wheel Switch

It is well known that an emery wheel requires a considerable amount of power when running, even though no grinding is being done. It is also true in most shops that the men who use the wheel are very careless about shutting off the power when they are through using it. In order to prevent this waste of power a treadle device for throwing the switch can be used, as shown in the accompanying sketch, says the Railway Age Gazette.

The original switch A, has an extension B, bolted on, and this, through the two connections and the lever C, is connected with the upper arm of the lever D. This lever is pivoted at its lower extremity on a fixed shaft and has a bell-crank extension, at the end of which there is a treadle. Midway up this lever D, there is a helical spring which bears against a stop on the machine. When the machine is to be used, the operator puts his foot on the treadle and by pressing it down, throws the switch in and closes the motor circuit. He holds his foot on the treadle while he is at work, and when he lifts it to go away the spring throws out the switch and the wheel stops.



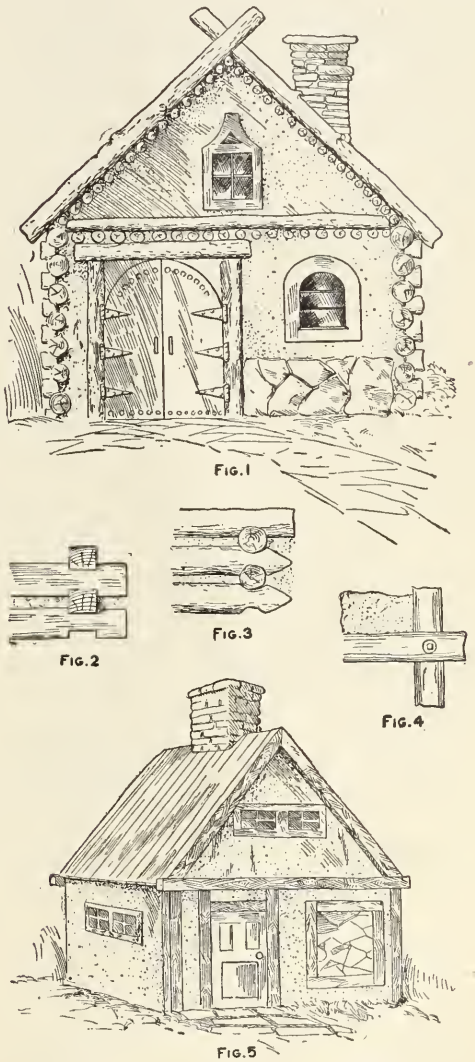
Switch Worked by a Foot Lever

Concrete Log Houses

Since the application of cement to so many kinds of structural work, there have been numerous designs created in connection with log houses. The development of the cement industry has enabled architects to form designs of modern log residences for the country, the beaches, the city estate or wherever required, says Rock Products. Some of the designs of logs in combination with concrete effects are exceedingly attractive in appearance. Stone or pebbles for the rubble surfaces are used with good effect, while other types are executed with imitations of the natural materials in cement. There are cottages designed with the rubble surfaces set off with broken bottle green glass. Some good effects have been secured with hard wood set in blocks, angles, sections, curves and the like in the cement walls of the log frame cabins. There are other patterns possible; parts of frames, turns, etc., are utilized in conjunction with the rubble, cement and log work. Furthermore, models of attractive combination log and cement houses are made by introducing novelties in window sash, frames of heavy doors, metal doors, sheet iron or tile smokestacks, novel shaped windows, projecting ends of logs at the corners and kindred combinations.

One form of a log house is illustrated in Fig. 1. The house is built with log sides, and the front and back with cement covering on the log base. The sides can be filled in with cement, too, if desired, so that the log work only shows at the edges. Or, instead of having a smooth front, made with the cement packed in between the logs, the cement packing may be used for filling purposes only. This filling need not extend so deeply as to entirely cover the lines of the logs. The log surfaces will then show, resulting in a novel exterior for the building. The detail of putting up the logs is shown in the sketches in order.

The manner of uniting the edges of the logs, when it is desired to have the ends square, is shown in Fig. 2. The



Combination Log and Cement Houses

ends are simply chipped down to the square form required, and then the logs of one series are cut out so as to admit of the jointing with the logs of the other, as shown in the sketch. After the jointing work is completed,

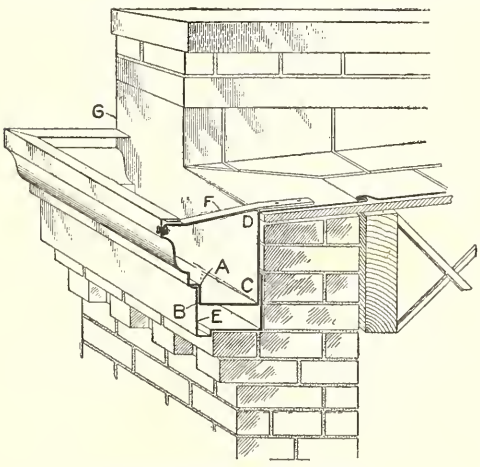
the mixed cement is packed in between the logs and permitted to set, resulting in a very firm and tight wall, if the work is correctly done. The cement, sand and water should be properly mixed and put in order for use. The cement, when too wet, cannot be properly packed. Again, if the mixture be too dry, proper packing will be equally difficult. Only when the mixture is of the right consistency, can it be placed securely in position and allowed to dry out. Such a concrete wall will last indefinitely.

A mode of effecting the corner connection, when the logs of one series are to be round, is shown in Fig. 3. The logs of one series are cut out oval-shaped at the joints and the logs of the opposite series are placed as shown. Then follows the concrete packing as before. Sometimes a joint is made with a bolt passing through the two logs at the terminal, as in Fig. 4.

A building erected with logs planed and their ends squared is shown in Fig. 5. This building is intended for service in parks, for care-takers on large estates, for garage purposes, etc. The wood should be of a quality capable of taking a finish. Polished hardwood door frames, window frames and framework for the entire structure give a building of this nature an attractive appearance, when built up in unison with the cement wall and fillings.

False Bottoms for Roof Gutters

All gutters must, obviously, have a pitch or fall toward the outlet, and in the hanging type, such as the eave



False Bottom in the Gutters

trough, this fall is perceptible from the ground. Often if the fall is pronounced, it destroys the symmetry of the house. To overcome this, the molded face styles are made throughout and a false bottom which has the necessary fall to the outlet, soldered in, says the Metal Worker. Considerable trouble is experienced with these bottoms, owing to their breaking from the sides of the gutter, despite rivets and soaking in solder.

Inasmuch as these gutters are intended to be ornamental, the sketch shows how this ornamentation can be enhanced by extending a few of the stretcher courses of the brick work, and by alternating the bricks of the header course one in and one out, an appearance of dentil blocks is obtained.

The gutter proper can have the required pitch in the vertical members A, B and CD, and the facia piece E made separate and with a drip as shown. This facia piece is soldered to the gutter and, as gutters are usually made of heavy material, can be one or two gauge lighter.

At the lowest point or outlet, the bottom of the gutter will be down to the horizontal line of the facia piece, which rests on the brick work. The outlet tube is put in and soldered in the customary manner and would either connect with a leader on the outside or the inside of the wall.

The braces F are of galvanized or tinned band iron, ⅛ by 1-in. stock, bolted to the front part of the gutter and riveted to the roof flange of the gutter as shown. These rivets are soldered watertight on the under side.

If, instead, it is specified that these braces be attached after the setting of the gutter and nails driven through to the roof sheathing, then the entire brace must be soldered to the roof flange of the gutter to prevent leaks through the nail holes. The braces are made all alike and spaced 2 ft. apart.

The gutters are made in a length on the crown line from the outer edges of the fire or battlement walls G. At the inner lines of the walls, the roof flange of the gutter is cut and flattened out and forms a flashing which goes up and under the cap flashing that was built in with the wall. The wall flashing connects with this flashing of the gutter as shown in the illustration. Should the wall flashing be very high at the outer edges of the walls, use some roofers' paint skin and secure it to the wall with hooks to keep rain from blowing in behind the flashing at G. A much better method would be to step the flashing into the brick work.

Improved Sleeve Ironing-Board

A practical sleeve ironing-board, having both top and bottom boards shaped for such use, is shown in Fig. 1. When the board is placed on the table, one can iron without bending over it. The small board is for ironing sleeves of shirtwaists and dresses, the other for waists, shirts, children's clothes and small pieces. This board will also fit the shoulders and fronts of waists.

The board is made of pine or basswood; the spool for the upright can be obtained from a tailor. After the boards are cut as shown by the dimensions and rounded at both ends, they are fastened to the spool with long brads. Bore holes through the boards matching the holes in the spool, fill them with hot glue and drive dowels of hard wood through both boards and spool.

Half a yard of white felt will be sufficient to cover both boards and extend over the sides, so that it can be fastened with tacks. One yard of unbleached muslin will make four covers for the outside. Two spools of narrow tape are used to run through the casings of the slips and the tape tied underneath

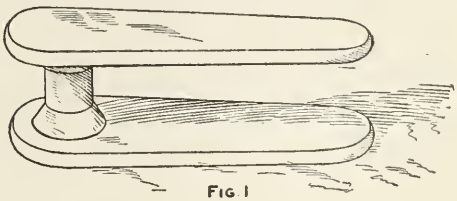


FIG. 1

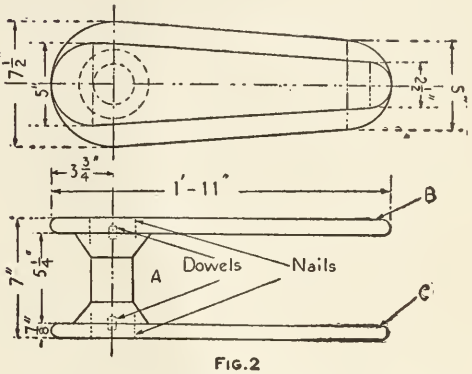


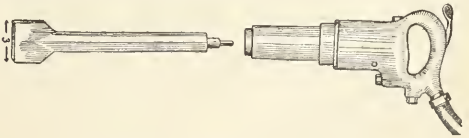
FIG. 2

Ironing-Board Details

the boards. Thus the slips can be easily removed and laundered. The upright, being made from a large spool, prevents the articles that are to be ironed from being caught underneath, and also gives depth enough between the boards to keep the waists and children's dresses in shape.—Contributed by Katharine D. Morse, Syracuse, N. Y.

Removing Old Paint with a Pneumatic Tool

Old paint on engine tanks can be quickly and effectually removed by using a boilermaker's 2½-in. stroke air-gun or pneumatic hammer, with a rip-

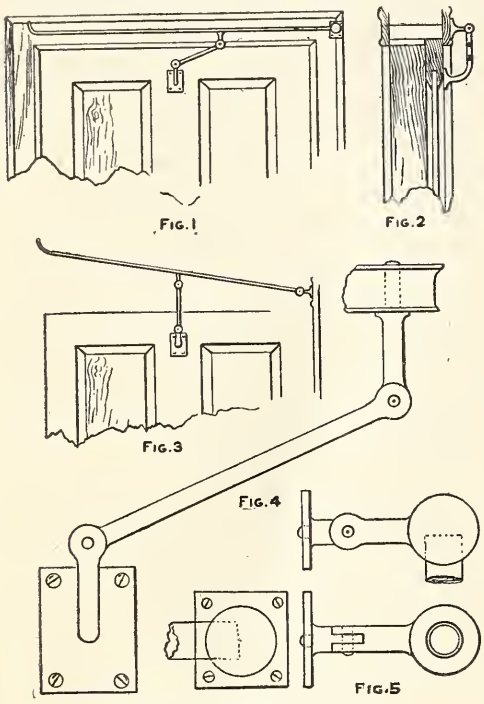


Pneumatic Hammer and Tool

per tool. Hold the ripper at an angle so as to clip off the paint and not cut into the metal.—Contributed by Harry F. Leonhardt, Minneapolis, Minn.

Automatic Lifting Curtain Rod

The accompanying sketch shows a curtain rod suitable for holding curtains in front of sitting room doors.



Details of the Curtain Rod

The rod is suspended in such a way that the opening of the door gradually lifts the curtain clear of the floor at the bottom edge. This is a decided advantage, as it allows the door to travel freely without the lower edge of the curtain dragging beneath the door.

In Fig. 1 is shown the rod in position when the door is closed and in Fig. 2 the side view. The rod should be made of ¾-in. brass tubing with one end inserted in a hinged joint, as shown in Fig. 5. The opposite end of the rod should be bent up to keep the curtain in place. If a bend in the rod cannot be made, a solid piece can be put in and soldered.

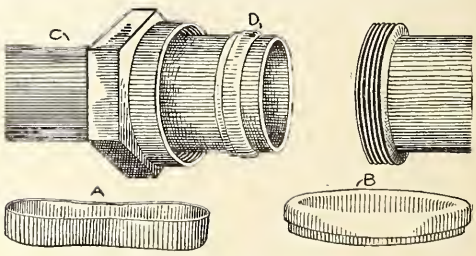
The hinge joint, Fig. 5, is to allow the rod to swing around with the door and at the same time turn slightly for the rod to rise. In Fig. 4 is shown the device for lifting the rod and Fig. 3 the position of the rod when the door is open.—Contributed by John T. Dunlop, Shettleston, Scotland.

Measuring Elevation by Water Pressure

To get the approximate difference in elevation of different parts of a city is a very easy matter where there is a waterworks system. This is done by attaching common steam gauges to the plumbing systems at each place and observing the readings. From the difference in pressure at the gauges, the difference in elevation in feet can be found. For every foot in height, the pressure will be .433 lb. per square inch. By multiplying the difference in pressure at the gauges for different elevations, by .433, we get the difference in elevation in feet. Suppose the gauge read 6½ lb. at the top of an elevation and 30½ lb. at the bottom. The difference is 24 lb. and this multiplied by .433 gives the approximate difference in height to be 10.392 ft.—Contributed by J. C. Murry, Lincoln, Nebraska.

Rubber Bands Used for Gaskets

The leaking of a rubber gasket on a piece of 2-in. nickel-plated pipe caused me to try an ordinary rubber band, A, in its place. In fact I used two rubbers, one over the other and each doubled as shown in B. When placed in position,



Rubber Band Used for Gasket

D, and the union parts screwed up, it made a tight joint. The rubber being elastic makes it adjustable, which is not the case with the ordinary gasket.—Contributed by J. M. Kane, Doylestown, Pa.

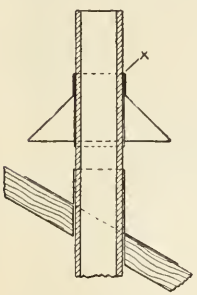
Pasting Labels on Tin

The curling of labels on tin, especially when the cans were first labeled and then filled with hot liquids, gave us much trouble in our factory until we started experimenting with the paste. We label our cans empty and then fill them with hot syrup, conditions which call for a very tenacious, tacky paste.

We use a fairly thin glue, made by soaking sheet glue in warm water until dissolved and then adding about one-fourth as much glucose (by volume) as we have glue. This paste applied either hot or cold with a brush will stick tight, will not affect the inks on the labels, as glycerine is apt to do, and will never curl, no matter how hot the contents of the can; neither will ordinary dampness loosen it. We have labeled more than a million and a quarter cans with this paste and have yet to see the first label so much as loosen at the corners.—Contributed by C. A. Munsterman, Peoria, Ill.

Attaching Pipe Flashings

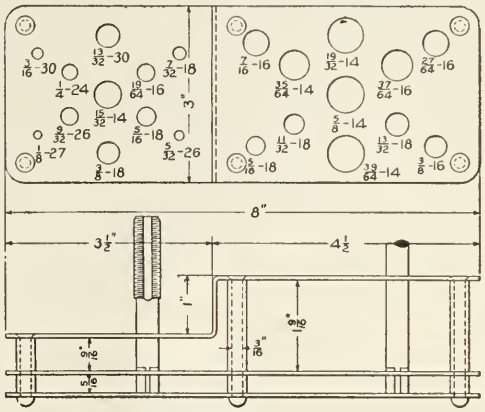
A novel method of attaching pipe flashings to exhaust, vent or vapor pipes that are subject to expansion and contraction, so that the rain will not follow down the pipe is shown in the accompanying sketch. Simply cut a groove, X, about ⅛ in. deep, about the pipe at the proper height, with a pipe cutter, then when the flashing is in place, bend the top edge into this groove. This will form a tight joint and prevent the rain from following down the pipe through the roof.—Contributed by S. S. Erickson, Seattle, Washington.



¶Do not lubricate magneto bearings too freely.

Steel Tap Rack

A simple and compact tap rack, which can be made in a couple of hours,



Details of Tap Rack

is shown in the accompanying sketch. It will prove to be a time as well as a trouble saver, and being made of steel, it is well able to stand the rough usage to which all shop tools are subjected, and consequently very durable. Each hole in the top plate should be marked with the number of threads and the size of the tap it is intended to hold. The holder can be made larger or smaller than the one shown, but this size will be found about correct for the ordinary shop.—Contributed by C. A. Allen, Linwood, Mass.

Combination Scale and Scriber

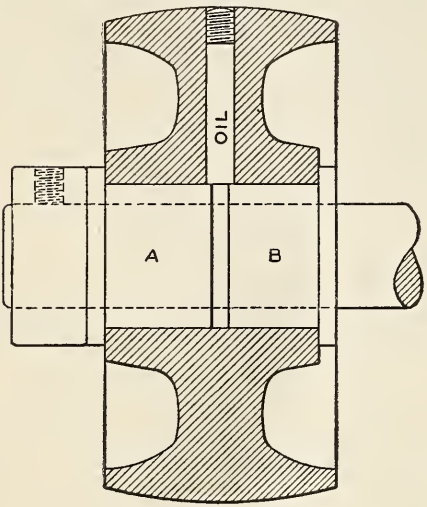
The accompanying sketch shows a 6-in. scale to which is attached a scriber made of tool steel. This scriber also acts as a pocket clip; in fact, that is the purpose for which it was originally designed, says a correspondent of Machinery. As a scriber is mostly used

Scriber on Rule

with the scale, the upper part of the clip was extended to form a scriber point, thus combining two tools in one.

Bushing Loose Pulleys

One of the jobs that frequently fall to the lot of the repair man is that of renewing the bushings in loose pulleys,



Details of Bushing

says a correspondent of the American Machinist. Being regarded as a job not requiring a high order of skill, they are generally given to the poorest lathe hand, or to the boys. As a result, a simple job is the cause of considerable loss and inconvenience.

It is the usual practice to make these bushings of brass and to make tight fit in the pulley. Times without number, I have seen pulley hubs cracked through the desire to make the bush tight enough, and the bushing hole reduced in size, making necessary another operation in reaming or scraping the hole to fit the shaft. The brass usually found around the shop is not of the right character for the use to which it is put, and the slightest neglect in oiling starts it on its noisy way back.

The accompanying sketch illustrates a method we have employed for some years and for simplicity and economy in construction and efficiency in operation it is far ahead of the tight bushing. It has given complete satisfaction whenever used.

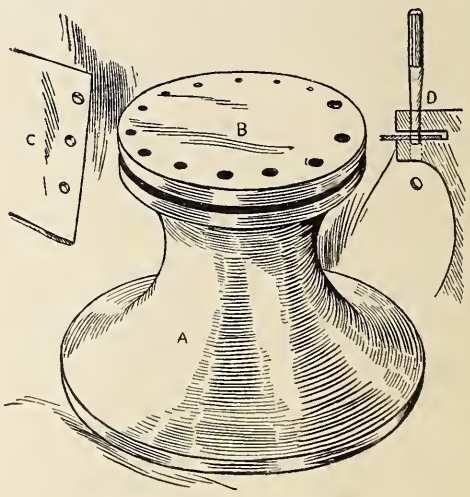
It consists of two flange bushings, A and B, of cast iron, bored and turned a running fit on the shaft, and in the pulley, with oil grooves inside and out, and an oil space in the center. Space for the flanges is obtained by facing the pulley hubs where necessary.

This style of bushing is easier to make, therefore cheaper, and will stand more abuse and neglect than the tight brass bushing, and if once used you will not revert to the old method.

Punch Block for Small Holes

Sheet metal workers will find the punch block, shown in the accompanying sketch, very handy for punching small holes in sheet metal. Its small size permits of it being carried about from place to place.

Turn up a block of steel, A, in the lathe to the desired size. Cut a groove about $\frac{1}{8}$ in. wide in the edge of the top flange. Around the top edge drill holes ranging in size from $\frac{1}{16}$ in. to



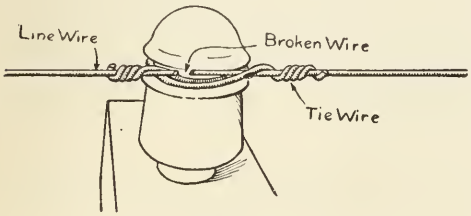
Punching Holes in Sheet Metal

$\frac{1}{4}$ in. and have a set of punches made to fit them. In punching a hole, slip the sheet C in the groove under the proper hole and set the punch on it. A sharp blow with a hammer will force the punch through, cutting a

smooth, clean hole. Better results will be obtained if the top flange is hardened after it is finished. The work done with this punch is fully as good as that done with a more expensive punch press.—Contributed by C. Purdy, Ghent, O.

Noisy Line Caused by a Tie-Wire Break

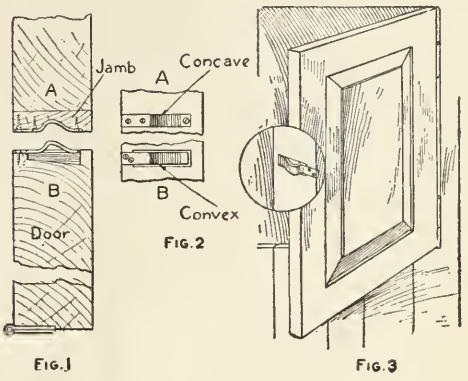
Having gone over a line that was reported noisy, and satisfied myself that the trouble was not in the instrument or fuses, I concluded that it was in the aerial, of which there were eight spans between the cable box and the instrument, says a correspondent of Telephony. On climbing a pole and examining the glass where the line was tied, I found the copper wire corroded and parted. It was held in place by the tie-wire, which was wrapped to hold the wires up, but would allow the ends to move just enough to cause the line to be noisy when a conversation was in progress. Splicing in a new wire cleared the trouble.



Showing Point of Break

Invisible Door Catch

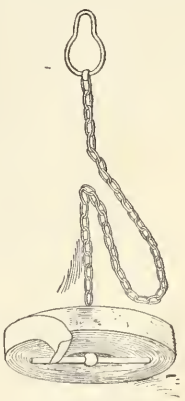
A catch for small doors on cabinets, bookcases, etc., can be easily and quickly made of two pieces of spring brass about ¼ in. wide. These pieces are bent as shown in the sketch, one to form the concave, A, and the other to form the convex, B, part of the catch. The concave piece is fastened to the door jamb so that it will extend to the outer edge of the jamb as shown. The convex spring is then fastened to the door over a slot previously cut in and exactly opposite to the concave piece, so that they will fit together when the door is closed. The slot over which the spring B is fastened should be cut deep enough to admit the end when it is pressed down flush with the edge of the door. This catch will hold the door securely, yet not so tightly that a slight pull will fail to open it.—Contributed by L. M. Eifel, Chicago, Ill.



Invisible Door Catch

Electrician's Tape Carrier

Secure an old key chain and put a wire through the end of it in place of the ring. Bend the wire around so it will not work loose from the chain. Slip the roll of tape on the chain as shown in the sketch. If allowed to hang outside of the garments, it will always be at hand when wanted, and save the electrician considerable time. —Contributed by W. T. Tarr, Joplin, Missouri.



¶Do not screw a spark plug in tight while the motor is hot. The result will be stripped threads when removing after the motor has cooled.

Calipering over Flanges

When it is necessary to gauge the thickness of a piece of work which lies behind a flange, the ordinary calipers

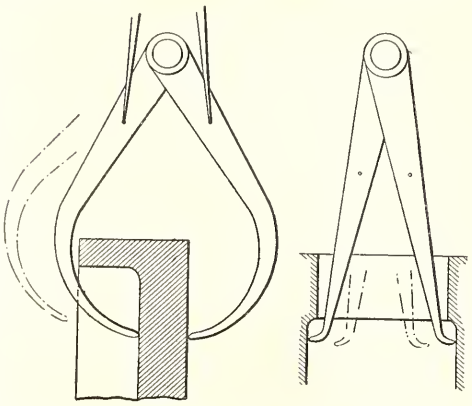


Fig. 1—Calipering with Prick-Punch Marks

are of no use, because the dimension is lost as soon as the calipers are opened for removal, says Machinery. The view to the left in Fig. 1 shows a neat method of repeating the setting. All that need be done is to make a fine prick-punch mark on the face of each leg, and carefully measure the distance between these marks with the points of a pair of dividers. After the calipers are removed they should be closed until the punch marks again coincide with the divider setting, when the dis-

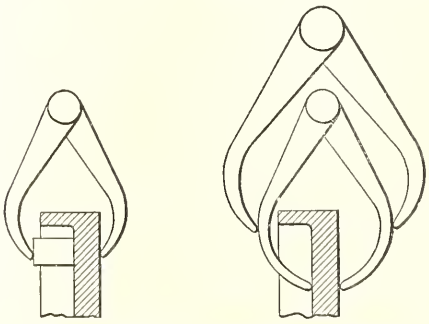


Fig. 2—Block or Two Pair of Calipers

tance between the caliper points will equal the thickness of the work. If this is done with care, very accurate results may be obtained. The same method is applicable to inside calipers when taking the size of chambered recesses, etc. The caliper setting is changed, as shown by the dotted lines, to get them out of the narrowed hole, and then they are again opened until the punch marks are the correct distance apart.

The methods shown in Fig. 2 are quicker and will permit measurements closer to the corner under the flange, To get the thickness of the flange, simply use a block as shown to the left in Fig. 2, then subtract the thickness of the block from the measurement obtained by the calipers. This method can also be used for measuring a chambered recess. If a block is not at hand, use a second pair of calipers as shown to the right in Fig. 2. After removing the first pair of calipers from the work, replace them to size by means of the second pair.

How to Repair a Cracked Water Jacket

Through neglect and carelessness many a gas engine water jacket is burst by being left with water in it on a very cold night. A crack of this sort gives a great deal of trouble and many times results in a loss of time in replacing with a new jacket or sending it to some factory to have it brazed.

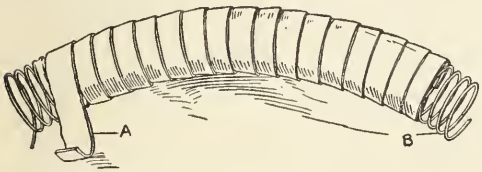
If the crack is in such a place that no strain comes on it except the water, it may be repaired in the following manner and will hold water as well as a new jacket would.

Mix litharge with glycerin to a stiff paste and force it into the crack with a putty knife or some similar instrument. After filling the crack, let it stand over night, if possible, and on starting in the morning run the engine until it gets well warmed up before turning the water into the jacket. If this mixture is properly applied, the job will be likely to last as long as the engine. One advantage it has over brazing is that it will give way again before breaking the cylinder, if the careless-

ness is repeated, and in this case, the mixture can be applied again in a short time and no serious delay will result. It is also valuable where the crankcase has been patched and leaks oil. This paste can be used in putting together the case in place of the regular packing. When the case is taken apart, the paste will cling to the metal and can be replaced as the regular packing.—Contributed by J. N. Bagley, Webber, Kansas.

An Emergency Hose

When in need of a short piece of hose for a siphon one day and having no ordinary hose at hand, I proceeded

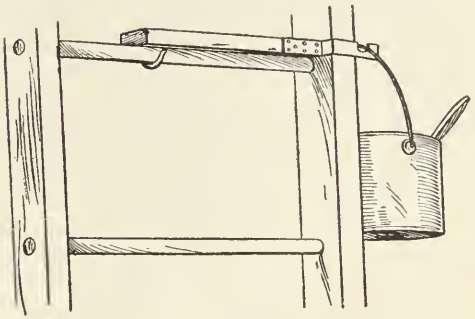


Oilcloth Wrapped around Spring

to make one from a blind roller spring and strips of oilcloth. The oilcloth was cut in strips 1 in. wide and then wrapped around the spring in a spiral, allowing each edge to overlap the other about 3/8 in. The oilcloth is shown at A and the spring at B in the sketch. Adhesive tape would be much better, but the oilcloth did good service.—Contributed by Wm. A. Robinson, Waynesboro, Pa.

Paint Pot Hanger Attachments for Ladders

The painter using a hook on the rung of a ladder for a pot hanger knows only too well how hard it is to dip the brush in the paint and draw it out without smearing the ladder or hands. The hanger illustrated herewith can be quickly adjusted to the ladder so the pot will hang n either side as desired. The pot is out of the way of the rungs and is free for dipping the brush in the paint. It consists of a strip of board about two-thirds as long as the rungs on the ladder, with two strips of iron fastened to one end and bent around the upright as shown. The irons are

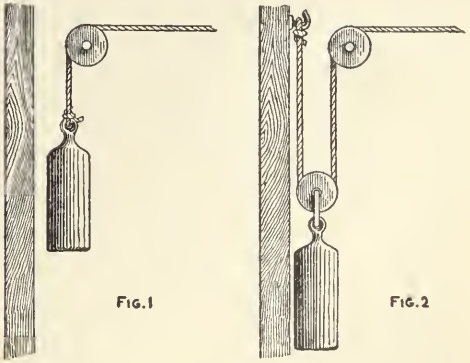


Pot on Hanger

notched on the ends to receive the bail of the pot. A small screw hook turned into the under side of the other end of the board holds the device in place on the rung desired.—Contributed by W. A. Jaquythe, Richmond, Cal.

Halving the Pull of a Weight

Sometimes the weight used to close a door or a gate is too heavy, and it is not convenient to secure a lighter one, says House and Garden. If you have a spare pulley that you can fasten to the top of the weight, you can reduce its pull one-half by lengthening the cord and carrying it through this pul-



The Weight Applied in Two Ways

ley, as shown in the illustration. The same weight is supposed to be used in both sketches, but arranged as in Fig. 2, it will pull only half as hard as in Fig. 1.

How to Make a Durable Heat-Black Finish on Brass, Bronze and Copper

The so-called "heat-black" finish on brass, copper or bronze, is one of the new methods of coloring metals that have recently appeared, and is one of the most durable. The color is an absolute dead black and is not difficult to apply to brass, bronze or copper, says the Brass World.

The article to be treated should be free from grease, although a slight tarnish does no harm. It is customary to sandblast the surface, although very good results may be produced without it. A sandblasted surface takes an excellent finish, but those who do not possess the necessary apparatus need not have any hesitation about using the finish.

Two stock solutions are first made up. One is a solution of nitrate of copper in water, and the other is a solution of nitrate of silver in water. The proportions need not be very exact, although it is preferable to keep them fairly close. The first is made up of 1 oz. of water, and 1 oz. of nitrate of copper. This gives a saturated solution of nitrate of copper in water and is used for a stock solution. If desired, the nitrate of copper may be easily made by taking 1 oz. of strong nitric acid and dissolving in it all the copper wire it will take up. A thick, blue solution is left, which is used for the stock solution. A few platers have nitrate of copper in stock, but if it cannot be readily obtained, it can be made up from copper wire.

The nitrate of silver solution is made up of 1 oz. of water and 1 oz. of nitrate of silver. This solution can be made up, also, by dissolving pure silver in nitric acid, until no more will dissolve, but dilute acid of equal proportions should be used, as silver does not dissolve readily in strong nitric acid. It is preferable, however, to purchase the nitrate of silver, as it is easily obtained. The nitrate of silver solution is practically a saturated solution and is used as a stock solution.

The mixed solution for applying to the metal is made as follows: water, 3 parts; nitrate of copper solution, 2 parts; nitrate of silver solution, 1 part. The solution is kept in a glass or stoneware vessel for use.

The brass, bronze or copper article to be treated is heated on a hot iron plate or in an oven to a temperature of about 250 deg. F. and the solution applied with a brush or cotton swab, so as to cover the surface uniformly. The brush should be a rather soft one so as to put on the coating in the best manner. The so-called rubber-bound brushes are the best for the purpose as there is no metal on them to be attacked by the solution.

One or two coatings of the solution on the surface of the article is usually enough, and it dries almost immediately, leaving a sort of green froth. The temperature is not sufficiently hot to draw the temper of hard brass, but it will usually melt soft solder.

When the entire surface has changed to a uniform black color, allow the article to cool and then brush off the fluffy material on the surface of the metal with a stiff bristle brush. The color will now change to a brownish-black that is quite pleasing for many purposes and which is very tenacious. When the fluffy material is completely brushed off, it is surprising how even and uniform the coating is and how well it adheres. If the brown black finish is desired, the surface may be now waxed or lacquered, but it is customary to give the article an additional treatment in a liver of sulphur solution, so as to change the brown-black coating to one that is absolutely dead black.

When the smut has been brushed off from the surface of the article, it is immersed in a cold liver of sulphur solution for five minutes. This solution is made by dissolving 2 oz. of liver of sulphur in 1 gal. of water. The article is immersed in it, allowed to re-

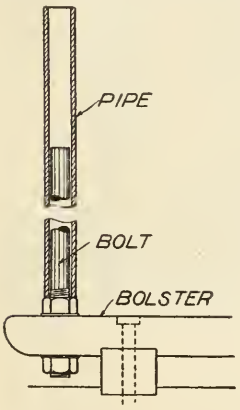
main about five minutes and then, without rinsing, is again heated until the surface is uniformly black.

The surface is again brushed with the bristle brush, when it will be found that the color is a dead black and quite uniform. It should be borne in mind that the article is not rinsed at all after it is removed from the liver of sulphur solution, but is simply drained off and then heated.

The article is now lacquered with a flat lacquer or waxed as may be desired. The final appearance of the surface will be found quite satisfactory and, contrary to what one would naturally expect, the coating of the solution that is first applied need not be very even, as long as a sufficient quantity is put on. If the surface is not satisfactory, or an old article is to be refinished, the wax or lacquer may be burned off and the process repeated.

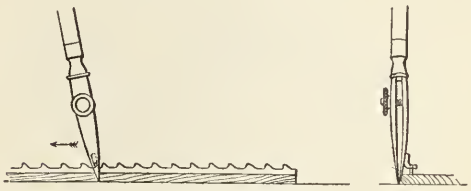
A Bolster Stake for Lumber Wagons

Some lumber companies equip their wagons with strong stud bolts, instead of the ordinary wooden bolster stakes. These bolts are much stronger than wooden stakes and hold the load much more securely. The bolt is about 18 in. long and is secured to the bolster with nuts on both sides, as shown in the accompanying illustration. This bolt is long enough for all ordinary loads, but when a higher load is hauled, pipes are slipped over the bolts as shown and the tops tied together with chains to keep them from spreading. These stakes are much handier to use than the wooden ones with the rings and pins.—Contributed by J. V. Romig, Allentown, Pa.



Dotting Attachment for Ruling Pens

The accompanying illustration shows a dotting device which a writer of Machinery uses in place of the expensive wheel or other dotting pens. The advantage of this is its cheapness, and the fact that either dotted or full lines may be drawn without any change whatever. A small rack with a series of rounded teeth is attached with cement or other adhesive to the face of the straight edge or T-square a little way back from the edge. On the back of the inner pen blade, a small piece of brass is soldered with a portion of the upper end turned out at right angles, so as to lie parallel with the face of the straight edge. This brass pin is set at such a height that when the pen is tilted over, about as illustrated, the pin just clears the bottom of the grooves in the rack, consequently permitting the pen to ink on the paper. In use, the pen is moved along, keeping it at the angle shown, and the teeth cause it to jump up and down, producing a series of dashes on the paper. A dotted line can be drawn in this way as far as a full one, and without any of the fatigue which is caused by dotting in the usual way. The pen should be held lightly, to let it rise and fall in an easy manner. By simply bringing the pen into a vertical position, the brass pin will clear the tops of the rack teeth, and a full line can then be drawn. The rack can be made from a piece of hacksaw blade, by reducing its width and filing out each alternate tooth and rounding off the remainder to suitable outlines.

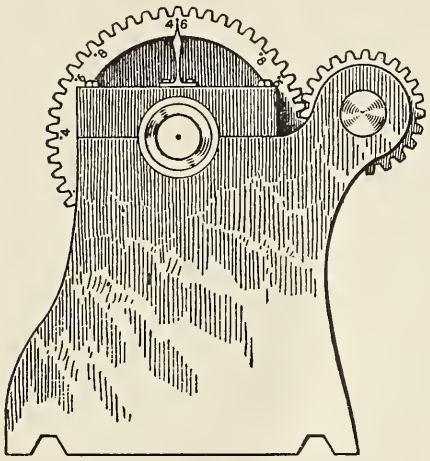


Dotting Attachment

¶Test a lathe for end shake from time to time.

Marking Turned Work in the Lathe

The lathe hand often has occasion to line off a turned piece of stock into a certain number of equal divisions, or



Gear Marked Off in Equal Divisions

parts, as in laying out bolt heads of triangular, square or hexagonal shape, in scribing a piece of stock for a key seat, or, in fact, in any case when equal spacing is required on a piece of turned stock. This is easily done, if the face of the large gear in the lathe head stock is marked off into equal divisions, and a stationary pointer supplied as shown in the accompanying sketch. Turn the gear until the hand points to the proper number, then scribe the work with a tool held in the toolpost. This puts the mark in the proper place. By putting in the back gears, the indications can be brought up very nicely. This idea can be applied to a great many other purposes.—Contributed by A. G. Smith, New York.

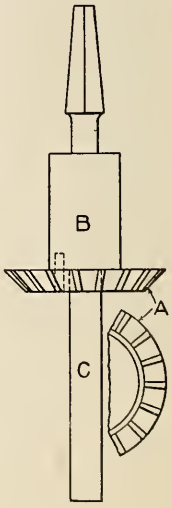
How to Cover a Pulley

It is an easy matter to cover a pulley, if the covering is prepared in the proper manner. The first thing to do is to remove all the old covering and pull out the nails and, if necessary, remove the wedges and replace them with new ones. The leather to be used for the covering should be wider than the pulley to be covered and about 3 or 4 in. longer than is necessary to reach around the pulley. Soak the leather in a pan of warm water for almost one hour. Square one end of the leather and nail it to the wedge, using nails that will just reach through and clinch on the side next to the pulley.

Stretch the leather as tight as possible and nail to the next wedge and continue until the last wedge is reached. Nail the leather to the last wedge before cutting it off. Trim the leather down to the rim of the pulley and the job is finished. Allow it to dry a short time, say 15 minutes, before putting it in service. If the leather is riveted to the pulley instead of being fast to the wedges, proceed in the same manner, punching the holes after the leather has been stretched.

Tool for Reseating Gas Engine Valves

Gas engine exhaust valves often become pitted from the action of the gases, and where the pits are not too deep, they can be ground out with emery very easily. If the valve has become warped from excessive heat, or the pits are too deep, it must be sent back to the makers to be reground and trued. The ordinary repairman can do the work just as well as it can be done at the factory and save much time, if he has a tool like the one shown in the accompanying sketch.

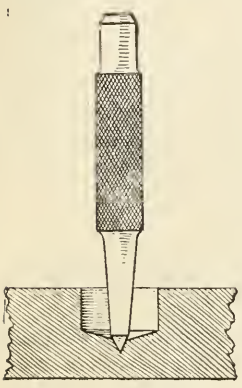


A cutting tool, A, is fitted on an arbor, B, and held in place by means of a pin. The arbor shank C should be of the same size as the valve stem, in order to hold the tool in line when in use. The arbor has a hole in the end to receive a common brace bit shank, so that it can

be turned. The cutting tool is made the exact size of the valve seat and has a pitch of 45 deg. After the tool has been shaped, cut small teeth around it as shown, being careful that all the cutting edges are of the same height and have the same pitch. The hole through the tool must be made to fit the arbor securely, but not so tight that it can not be removed for grinding. To temper the tool after it is finished, heat it to a cherry red, then plunge it into water or oil. Heat a block of iron and lay the tool on it, large side up, and draw to a deep straw color and cool. This tool will be valuable to the repairman who has much work of this kind to do on automobiles.—Contributed by J. N. Bagley, Webber, Kans.

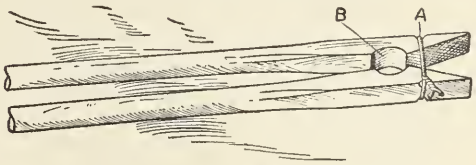
Drilling Holes in Metal by Hand

Drilling a deep hole in metal with a brace-drill is a very hard job, as it takes quite a pressure to make a drill point take hold. In order to relieve the point, mark the work with a center punch which is well pointed. Drill until the punch mark is out, then make a new mark, say ⅛ in. deep, and drill again. Continue by marking and drilling and you will be surprised how quickly and easily a hole can be drilled.—Contributed by Ernest A. Nielsen, Boston, Mass.



Wrench for Turning Nickeled Fittings

I had occasion to move a bathtub and did not want to mar the coupling to the floor connection. I took two pieces of hard pine and cut the ends as shown in the sketch, mortising them as shown at A, so they could be tied together with a short piece of wire. The pieces should be at least 1½ by ⅞ in. and of a convenient length. They

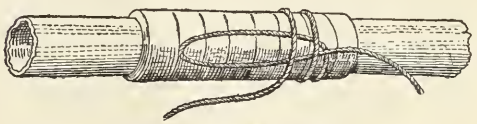


The Wood Cannot Mar the Nickel

can be cut out quickly with a pocket knife.—Contributed by Orris A. Cummings, Palmyra, Ill.

Making Flexible Hose Connections on Auto Engines

When a clip is too large to tighten up properly on rubber water connections, wrapping a few turns of insulating tape



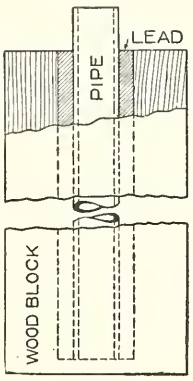
Enlarging Hose for Clips

round the tube to enlarge it, is a ready way of making the clip hold. A good substitute for a clip, and one that makes a good job, is to bind the tube with heavy twine, says the Automobile Dealer and Repairer. It is better than wire, and when wound on neatly and secured without a knot by underlaying the end, it looks well. To place it on, take about 5 ft., double it like a hairpin about 6 in. from one end, and lay it on the tube. Take the first round turn over all about 2 in. from the bend and draw taut, following with as many more turns as may be required. Work toward the loop, as shown in the sketch, but keep the turns close together. Pass the long end through the bend or loop, pull the short end, drawing the bight well under the turns, and then cut off the ends close.

¶Safety razor blades can be sharpened by immersing them in a solution of 1 part, by weight, of muriatic acid and 20 parts water for 30 minutes, then removing them and honing each one to a polish.

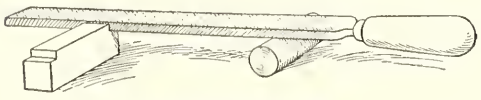
Casting a Short Lead Pipe

A plumber, who was finishing a job in the country, found himself short of about 1 ft. of lead pipe. As he was some distance from the supply shop, he devised the scheme shown in the accompanying cut for making the extra length of pipe from scrap lead. Securing a dry wood block of the proper length, he bored a 1¼-in. hole into it, lengthwise, with an ordinary wood auger. He set a ½-in. pipe, to serve as a core, in the center of the hole. He then melted his lead and poured it about the pipe, first greasing the wood and core to keep the lead from splattering. When the lead had cooled he split the block, removed the ½-in. pipe and found his cast pipe to be just what he needed.—Contributed by James E. Noble, Toronto, Canada.



Filing the Edges of Short Surfaces Level

We had a few thousand small steel pieces ¼ in. wide with a little corner cut out, to be filed as shown in the sketch. It was difficult to file these and get them straight without sloping over on the outside edge, or filing more in front than on the back or vice versa. The method we finally adopted was

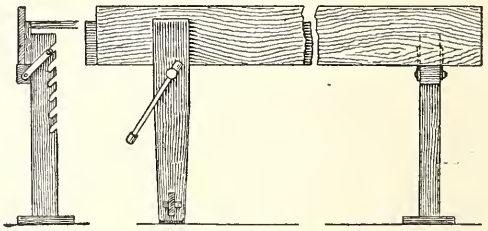


Filing Surfaces Flat

rather novel. The pieces were placed on a flat metal plate with a steel roller of the same diameter as the height of the surface to be filed and in the positions shown in the sketch. The roller prevented the file from rounding the edge and also kept it from curving the shoulder in the other direction.—Contributed by Donald A. Hampson, Middletown, N. Y.

Holding End of a Long Board on a Bench

The ordinary carpenter's bench has an apron in which holes are bored for pins to hold the end of long boards. A device that is a good substitute for the pins and one that can be set at any point along the side of the bench, is shown in the sketch herewith. The main upright is a 2 by 3-in. timber, set on a square block. The top part of the upright along the back side is notched to receive a bolt. A block is attached with side bars in such a way



Bench Jack

that it may be raised or lowered to suit the width of the long board being surfaced on its edge.—Contributed by W. C. Heidt, Chicago.

Failure by Disintegration of Concrete Roofing Blocks

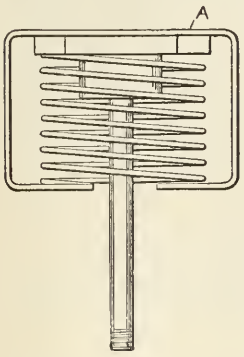
The porous character of the concrete and the use of cinder aggregate were apparently the cause of failure in the reinforced concrete slabs, used on the roof of the LaSalle station trainshed at Chicago. The slabs were made up of a gravel concrete exterior shell, ½ to ¾ in. thick; the interior portion was of cinder concrete, used to reduce the weight.

The disintegration was caused by gases and moisture penetrating from below the gravel concrete shell and entering the cinders. The steel was enlarged in sections or swelled by rust, causing it to crack off the cement. The

new slabs, used to take the place of the old, were made of stone concrete throughout and, when finished, were treated with a solution to close and seal all pores so that neither gas nor moisture can penetrate the facing of the concrete.

Tool for Inserting a Valve Stem

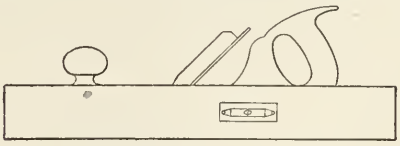
Often when inserting pump valves or other valves of a similar type, more or less trouble and inconvenience are experienced in getting the valve stem to catch the thread. This is on account of having to resist the pressure of the spring, while at the same time turning the stem, which, moreover, often has to be accomplished while reaching through a handhole. Therefore, if a number of valves are to be inserted, the work will be facilitated by temporarily compressing the springs to a uniform extent.



The accompanying sketch shows a very simple means of doing this. The flat piece of wrought iron A, about $\frac{1}{16}$ by $\frac{1}{2}$ in. is bent into the form of a rectangle, leaving an opening on one side. The ends of this opening are caught under the spring, and the opposite side slipped over the head of the valve stem as shown. Thus the stem can be quickly and easily turned in, and the piece of wrought iron as easily slipped off.

A Level on a Plane

The carpenter who does many jobs outside the shop is always trying to economize as much as possible on the number of tools he must carry. Many carpenters will be able to make use of the idea shown in the accompanying sketch for combining a level with a jointer plane. It is made by letting into one side of the plane a small level, such as may be bought for a few cents,



Combined Plane and Level

sinking it far enough in to be out of danger of breakage.—Contributed by C. W. Nieman, New York, N. Y.

A Sawdust Filler

The following preparation will be found useful for filling unsightly cracks and holes in furniture and woodwork. Place a quantity of sawdust in an earthenware vessel and pour boiling water over it. Let it soak for about one week, stirring frequently, then place it over the fire and boil until it is of the consistency of thick paste. Pour it on a coarse cloth and squeeze out the excess moisture. When wanted for use, mix a little of it with a thin solution of glue water and fill the cracks or holes with it. When dry and painted over, it will have the appearance of ordinary wood. —Contributed by Andrew Soderlund, Jr., Newport, R. I.

A Window Stop

Bend a piece of rod at right angles and bore a hole in the bend. Fasten it to the window frame at the edge of the sash by turning a screw through the hole into the wood. When attached, it

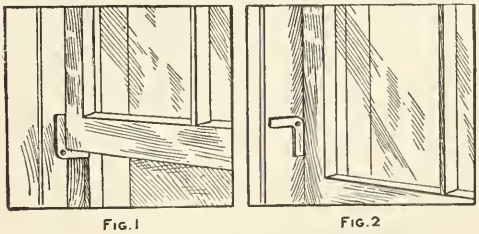


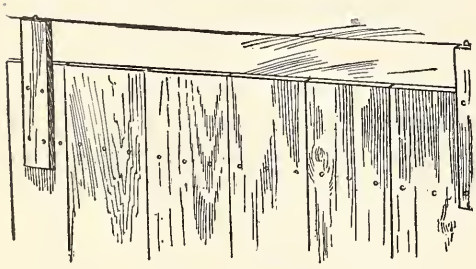
FIG. 1 FIG. 2

Catch in and out of Position

will support the sash as shown in Fig. 1. Figure 2 shows the sash released.—T. L. P.

Cat Guard for a Yard Fence

A simple way to prevent cats from using your back-yard fence for a concert stage is to place a wire 2 or 3 in.

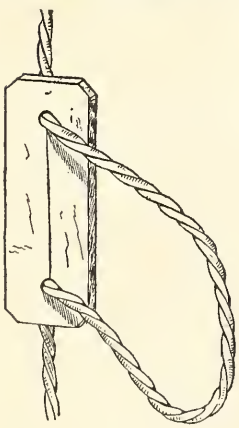


Wire on Fence

above and parallel with the top of the boards, and stretch it tightly. The wire makes it impossible for the feline to gain a foothold on the fence. The same method can be used to keep fowls from roosting on places where they are not wanted.—Contributed by Thomas L. Parker, Olaf. Iowa.

Flexible Lamp Cord Adjuster

While going through a local factory, I saw a device for holding an electric light and thought I might help others by passing the idea along. The device consisted of a piece of leather belt about 1 in. wide and 1½ in. long with a ⅜-in. hole punched in each end and the holes connected by a slit cut between them. The flexible cord is easily pushed through the slit, thus placing it in position without disconnecting the lamp socket. The cord can be pulled out in a loop so as to raise the light to any desired height. —Contributed by E. A. Gardner, Rochester, N. Y.



To Renew the Old Paint on a Buggy

The paint on a buggy soon loses its luster after it has been washed a few times. It may be brightened up, however, by the following method: Wash the buggy perfectly clean; then go over it with a rag moistened with linseed oil. Allow this to dry, then rub it with a soft rag.

Secure a pint of the best carriage varnish and a small can of paint of the same color as the original job. Add enough paint to the varnish to give it color, but not enough to cover up the stripes on the buggy when it is applied. Apply the same as varnish and allow plenty of time for it to dry. This adds much to the appearance of a buggy and protects the old paint.—Contributed by S. M. Hadley, Danville, Ind.

Tool for Cutting Boiler Plates

In the small machine shops where there is not a great variety of machines,

FIG. 1 FIG. 2

Roller Cutter

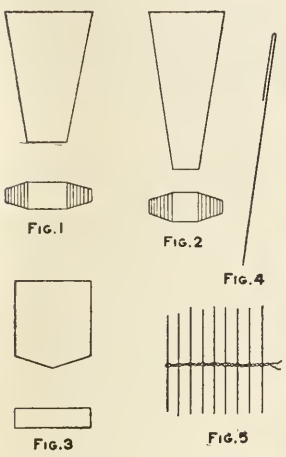
much scheming must be done sometimes in order to handle all kinds of work. In one shop of this kind it was necessary to split some sheets of $\frac{3}{16}$ and ¼-in. boiler plates. As there were no shears, the tool shown in the accompanying sketch was rigged up and used in the planer. A pipe cutter was fastened in a handle with a hardened steel pin as shown. By running this tool down the plate a few times, they broke quite easily.—Contributed by W. Clark, Cranbrook, B. C.

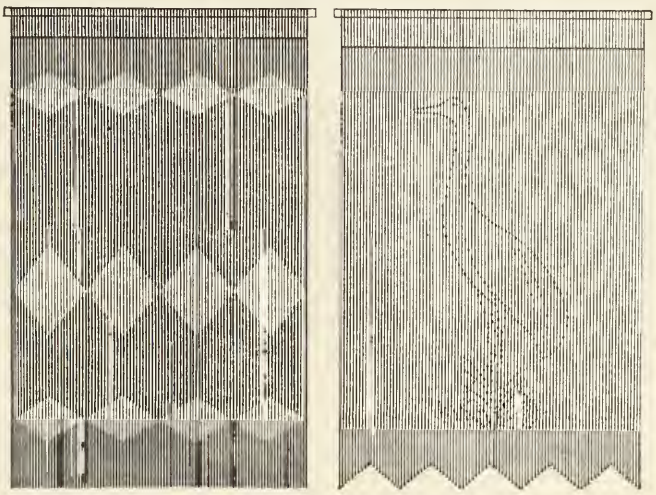
¶Storage batteries should fit or be held tightly in their box and all connections made secure. Sheet rubber is a good material for packing batteries. It deadens the vibrations and is a non-conductor of electrical currents.

AMATEUR MECHANICS

How to Make Japanese Portieres

These very useful and ornamental draperies can be easily made at home by anyone possessing a little ingenuity. They can be made of various materials, the most durable being bamboo, although beads of glass or rolled paper will produce good results. Substances such as straw, while readily adaptable and having a neat appearance, are less durable and will quickly show wear. The paper beads are easily made, as shown in Figs. 1, 2 and 3. In Figs. 1 and 2 are shown how the paper is cut tapering and as it appears after rolling and gluing down the ends. A straight paper bead is shown in Fig. 3.





Bamboo and Straw Portieres

The first step is to select the kind of beads desired for stringing and then procure the hanging cord. Be sure to get a cord having a size that will allow the beads to slip on readily and yet have the least possible lateral movement. This is important to secure neatness. One end of each cord is tied to a round piece of wood, or in holes punched into a leather strap. Iron or brass rings can be used if desired.

Cut all the cords the same length, making allowance for the number of knots necessary to produce the design selected. Some designs require only one knot at the bottom. It is best to make a rough sketch of the design on paper. This will greatly aid the maker in carrying on the work.

When the main part of the screen is finished, the cross cords, used for spacing and binding the whole together, are put in place. This is done with a needle made from a piece of small wire as shown in Fig. 4. The cross cords are woven in as shown in Fig. 5. As many of these cross cords can be put in as desired, and if placed at from 6 to 12 in. apart, a solid screen will be made instead of a portiere. The twisted cross cords should be of such material, and put through in such manner that they will not be readily seen. If paper beads are used they can be colored to suit and hardened by varnishing.

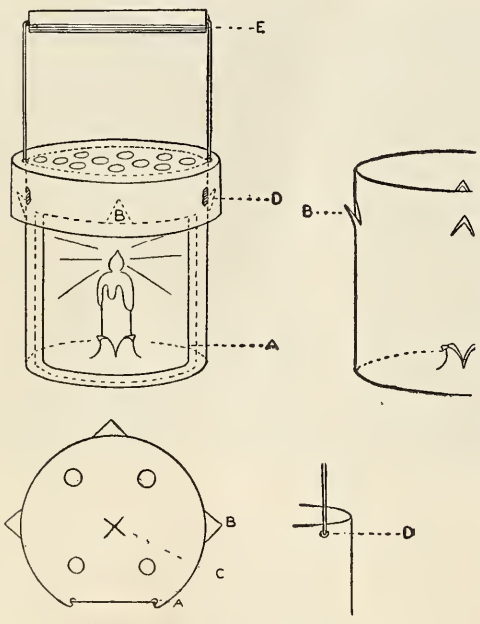
The first design shown is for using bamboo. The cords are knotted to hold the bamboo pieces in place. The fin-

ished portiere will resemble drawn work in cloth. Many beautiful hangings can be easily fashioned.

The second design is to be constructed with a plain ground of either straw, bamboo or rolled paper. The cords are hung upon a round stick with rings of metal to make the sliding easy. The design is made by stringing beads of colored glass at the right places between the lengths of ground material. One bead is placed at the extreme end of each cord. The rows of twisted cord placed at the top keep the strings properly spaced.—Contributed by Geo. M. Harrer, Lockport, N. Y.

Makeshift Camper's Lantern

While out camping, our only lantern was accidentally smashed beyond repair and it was necessary for us to devise something that would take its place. We took an empty tomato can and cut out the tin 3 in. wide for a length extending from a point 2 in. below the top and to within ¼ in. of the bottom. Each side of the cut-out A was bent inward in the shape of a letter S, in which was placed a piece of glass. Four V-shaped notches were cut as shown at B near the top of the can and their points turned outward. A slit was cut in the bottom, shaped as shown at C, and the pointed ends thus formed were turned up to make a place for holding the base of a candle. A larger can was secured and the bottom perforated. This was turned over the top of the other can. A heavy wire was run through the perforations and a short piece of broom handle used to make a bail.—Contributed by Maurice Baudier, New Orleans, La.



Lantern Made of Old Cans

New Tires for Carpet-Sweeper Wheels

The rubber tires on carpet-sweeper wheels often become so badly worn and stretched that they fail to grip the carpet firmly enough to run the sweeper. To remedy this, procure some rubber tape a little wider than the rims of the old wheels, remove the old rubber tires and wind the tape on the rims to the proper thickness. Trim the edges with a sharp knife and rub on some chalk or soapstone powder to prevent the tape from sticking to the carpet. A sweeper treated in this manner will work as well as a new one.—Contributed by W. H. Shay, Newburgh, N. Y.

How to Make an Ornamental Brass Flag

The outlines of the flag—which may be of any size to suit the metal at hand—and the name, are first drawn on a sheet of thin paper and then transferred to the brass by tracing through a sheet of carbon paper. The brass should be somewhat larger than the design.

The brass is fastened to a block of soft wood with small nails driven

through the edges. Indent the name and outline of the flag with a small chisel with the face ground flat, about $\frac{1}{16}$ in. wide. This should be done gradually, sinking the lines deeper and deeper by going over them a number of times. After this is finished, the brass is loosened from the block, turned over but not fastened, and the whole outside of and between the letters is indented with the rounded end of a nail, giving the appearance of hammered brass.

The edges are now cut off and four holes drilled, two for the chain by which to hang the flag to the wall, and two along the side for attaching the staff. The staff is a small brass rod with a knob attached to the top end.

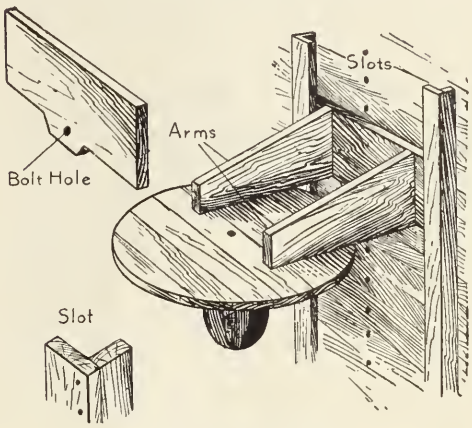
It would be well to polish the brass at first, if the finished work is to be

The Finished Flag

bright, as it cannot be done after the flag is completed. A coat of lacquer is applied to keep it from tarnishing. This is done by heating the brass and quickly applying a coat of shellac.—Contributed by Chas. Schaffner, Maywood, Ill.

An Adjustable Punching-Bag Platform

A punching-bag platform, suitable for the tall athlete as well as the small boy, is shown in the accompanying sketch. The platform is securely fastened to two strong wooden arms or braces, which in turn are nailed to a 2 by 12-in. plank as long as the diameter of the platform. This plank, as shown in the small drawing at the

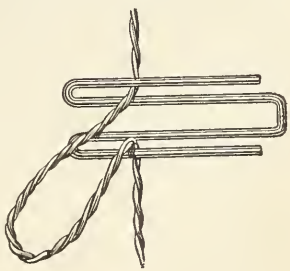


Adjustable Platform

upper left-hand corner of the sketch, is placed in grooves or slots fastened against the side of a wall. The plank with the platform attached may be raised or lowered to the desired height and held there by a pin or bolt put through the bolt-hole of the plank and into a hole in the wall.—Contributed by W. A. Jaquythe, Richmond, Cal.

Clasp for Holding Flexible Lamp Cords

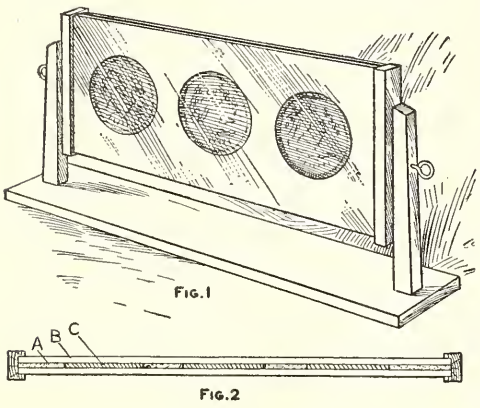
A very easily made drop-light adjuster is shown in the illustration. It consists of a piece of copper wire $\frac{1}{8}$ in. in diameter, bent as shown. This clasp is capable of standing a strong pull and will hold the lamp and socket with a glass shade.—E. K. Marshall, Oak Park, Ill.



¶Camel hair brushes for painters' use should never be allowed to come in contact with water.

Frame for Displaying Both Sides of Coins

It is quite important for coin collectors to have some convenient way to



Holding Coins between Glasses

show both sides of coins without touching or handling them. If the collection consists of only a few coins, they can be arranged in a frame as shown in Fig. 1. The frame is made of a heavy card, A, Fig. 2, the same thickness as the coins, and covered over on each side with a piece of glass, B. Holes are cut in the card to receive the coins C. The frame is placed on bearings so it may be turned over to examine both sides. If there is a large collection of coins, the frame can be made in the same manner and used as drawers in a cabinet. The drawers can be taken out and turned over.—Contributed by C. Purdy, Ghent, O.

How to Make Lantern Slides

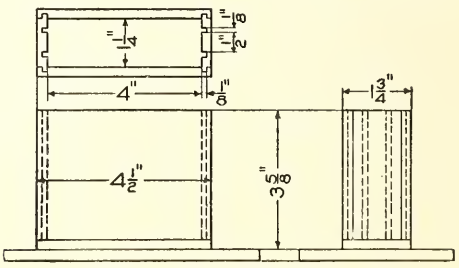
A great many persons who have magic lanterns do not use them very much, for after the slides have been shown a few times, they become uninteresting, and buying new ones or even making them from photographic negatives is expensive. But by the method described in the following paragraph any one can make new and interesting slides in a few minutes' time and at a very small cost.

Secure a number of glass plates of the size that will fit your lantern and clean them on both sides. Dissolve a piece of white rosin in a half-pint of gasoline and flow it over one side of the plates and allow to dry. Place the dried plate over a picture you wish to reproduce and draw the outline upon the thin film. A lead pencil, pen and ink or colored crayons can be used, as the rosin and gasoline give a surface that can be written upon as easily as upon paper. When the slide becomes uninteresting it can be cleaned with a little clear gasoline and used again to make another slide. A slide can be made in this way in five minutes and an interesting outline picture in even less time than that.

This solution also makes an ideal retouching varnish for negatives.—Contributed by J. E. Noble, Toronto, Canada.

How to Make a Developing Box

A box for developing 3¼ by 4¼-in. plates is shown in detail in the accompanying sketch. It is made of strips of wood ¼-in. thick, cut and grooved, and then glued together as indicated. If desired, a heavier piece can be placed on the bottom. Coat the inside of the box with paraffin or wax, melted and applied with a brush. Allow it to fill all crevices so that the developing box will be watertight. It will hold 4 oz. of developer. Boxes for larger plates



Details of the Developing Box

can be made in the same manner. Use a small wooden clip in taking the plates out of the box, being careful not to scratch the sensitive film.—Contributed by R. J. Smith, Milwaukee, Wis.

How to Make a Wireless Telegraph Set—Part V

By Arthur Moore

Construction of Telegraph Key and Aerial Wires

It is necessary that you have some means of making and breaking the primary circuit of your spark coil, so that there will be impulses sent out from the secondary winding corresponding to the intervals the primary circuit is closed. An ordinary telegraph key will serve the purpose very nicely when the primary current is not very large, and its mechanical operation will be the same as when it is being used on a telegraph line. The following simple construction may, however, be of interest to those who are constructing all of the various parts in preference to purchasing them, and want a key that will carry more current and have a larger and better contact than the ordinary telegraph key.

Cut from a piece of 1/8-in. sheet brass, a piece whose dimensions correspond to those given in Fig. 1. Cut a second piece, from some 1/8-in. stock, 5/8 in. wide and 7 in. long, and solder it to the first piece, as shown by the dotted lines D in Fig. 1. File off the edges and ends of this piece, after it is soldered in place, to conform to the outline of the main piece. Solder two other pieces, 1/2 in. wide and 3/4 in. long, to the first piece as shown by the dotted lines A and B, Fig. 1, and insert two pieces of 1/8-in. steel rod, of such a length that the ends project about 1/4 in. These projecting ends should be pointed, as shown in Fig. 2. Drill a 1/8-in. hole at F. The holes at H, G and I should be threaded for 3/16-in. screws. Cut another piece from some 1/8-in. sheet brass as shown in Fig. 3. The projecting arms P and P_1 should be bent up at right angles to the rest of the piece, at the points indicated by the dotted lines. Before bending these pieces, two holes should be drilled in them, as indicated in the figure, and threaded to take 3/16-in. screws. Place a 3/16-in. brass thumbscrew, with a lock nut on it, in the hole G, Fig. 1. The end of this screw should be turned down to 1/8 in. in diameter for a distance of 1/4 in. and a 3/8-in. washer of 1/16-in. brass made to slip on the end. Secure two 3/16-in. brass bolts, about 1 1/2 in. long, that are threaded their entire length and each having three or four washers and four nuts. Place one of these bolts through the hole H, Fig. 3, and fasten it in place with a nut on the under side. The other bolt should be fastened in the hole H_1, but insulated from the piece of brass. The hole H_1 should be drilled 5/16 in. in diameter and a small bushing with a 1/16-in. wall placed inside of it. The opening in the bushing should be 3/16 in. Place a metal washer on the bolt first, then an insulating washer and slip it through the hole and then place on a second insulating washer and metal washer and lastly the nut which will hold them all in place. This bolt should, however, have its head filed off flat and a small hole drilled in the center, into which a short piece of platinum wire is forced, and the projecting end hammered down, thus giving a platinum surface considerably larger than the area of the wire. Obtain two thumbscrews, about 1 in. long, that will fit the threaded holes in the arms P and P_1. Drill a 3/32-in. hole in the end of each of these screws and provide each with a small nut that will aid in holding them in place when their final adjustment has been made.

The piece shown in Fig. 3 can now be mounted on a wooden base. This base can be made from a piece of close-grained wood, about 1 in. thick, and its dimensions should correspond to those given in Fig. 4. The holes in this base should be countersunk on each side with a 5/8-in. bit to a depth of 1/4 in. so that the nuts on the screws used in mounting will be entirely below the surface. Mount two back-connected binding-posts in the corners of the base and connect them to the two screws with wires placed in grooves, cut in the under side of the base.

A small handle should now be turned

from a piece of hard rubber or very hard wood as shown in Fig. 5. This handle can be mounted on the piece shown in Fig. 1 with a 1/8-in. brass screw passed through the hole F from the under side. Obtain two thumbscrews about 1 in. in length that will fit the holes H and I, Fig. 1. Each of these screws should be provided with a lock nut. Drill a small hole in the end of the one you intend to put in the hole H and rivet a piece of platinum wire in place. A screw, S, should be provided on both the pieces shown in Figs. 1 and 3, to be used for electrical connections.

Make a small coil spring by winding a piece of No. 20 gauge steel wire around a 3/16-in. rod. The distance between turns should approximately equal the diameter of the wire, and the total length of the spring should be 5/8 in. Place the end of a piece of lamp cord about 4 in. long under the screw S, Fig. 1. Now mount the piece shown in Fig. 1 upon the piece shown in Fig. 3, making sure the coil spring is in place before the screws in the supports P and P_1 are given final adjustment. The other end of the piece of lamp cord can now be fastened under the screw S, Fig. 3. The screws in the holes H and I can now be adjusted, giving any desired movement of the handle before the contact is closed. The screw G can be adjusted to give any pressure of the spring desired.

It might be well at this point to give the construction of a special switch to be used in connecting the transmitting and receiving equipment to the aerial and ground. Figure 6 shows the scheme of connections, the switch being in the upper position when you are transmitting and in the lower position when you are receiving. The base of this switch should be made of slate or marble with its dimensions to correspond approximately to those given in Fig. 7. Cut from some 1/16-in. sheet brass, six pieces 5/8 in. wide and 4 1/4 in. long. Drill a 1/8-in. hole in the center of each of these pieces and bend them into the form shown in Fig. 8. Drill a 1/8-in. hole through two of these pieces after they are bent on the dotted line, shown in Fig. 8, as a center. Mount them all on the base with 1/8-in. brass bolts about 1 3/4 in. long. Each bolt should be provided with two additional washers and nuts to be used in making connections to the switch. Cut from some 1/8-in. sheet brass, two pieces 5/8 in. wide and 7 in. long. Drill a 1/8-in. hole in each end of these pieces, 5/16 in. from the end. Round off one end of each of the pieces to a 5/16-in. radius, with the hole as a center. Bend the other end over 5/8 in. from the end, forming a right angle. Cut from some hard rubber, a piece 6 in. long, 1 in. wide and 1/2 in. thick. Drill a 1/4-in. hole in the center of this piece and a 1/8-in. hole 1/2 in. from each end. These various parts can now be assembled as shown in Fig. 9. A small wooden handle can be attached to the rubber cross bar by means of a 1/4-in. screw, as shown in Fig. 9.

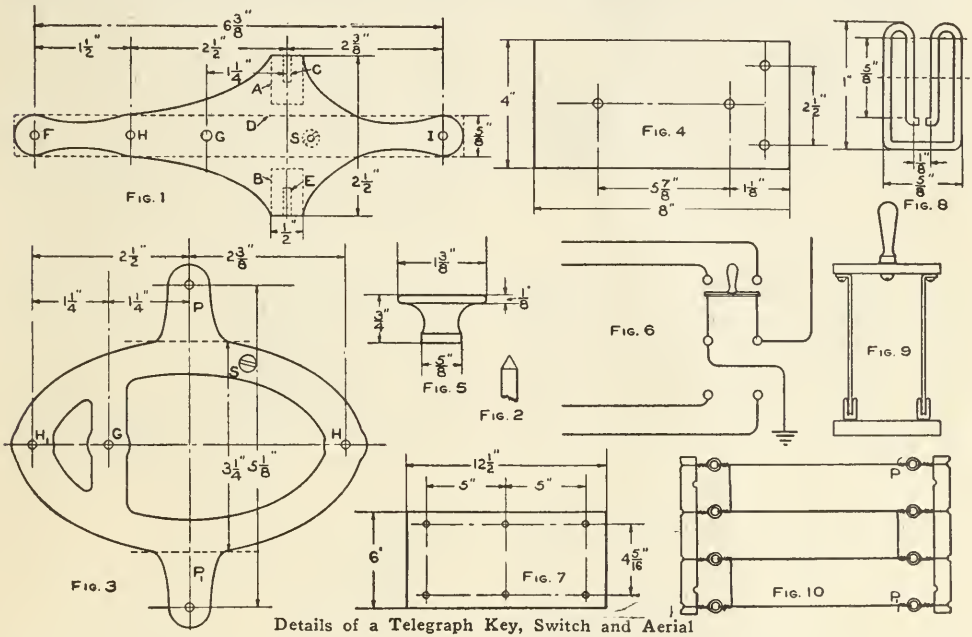
Your sending equipment is now complete, with the exception of the aerial. There are numerous forms of aerials and each is supposed to have certain advantages and disadvantages peculiar to itself. It is impossible to give the construction of all the different types, as it would lead to considerable confusion and you would be at a loss to know just which type to use. The type described below is known as the double ended "T" type and it is shown diagramatically in Fig. 10. First of all, you must select the location for your aerial, bearing in mind that it should be well up in the air and, if possible, not obstructed by adjoining buildings. You can no doubt place the aerial at the greatest height with the least trouble by supporting it on masts placed on the roof of the highest building near your station. The kind of mast to use will depend upon the requirements. In your case a 12 or 15-ft. mast will no doubt be ample, and a 2-in. iron pipe will do very nicely, as it can be easily handled. First obtain a good sized block of wood and cut it to conform to the shape of the roof. Then bore a hole in it that will take the pipe or wooden mast you are going to use and fasten it in place very securely.

Two or three guys should be attached to the upper end of the mast, before it is raised. They should be attached to the roof after the masts are raised in such a way that they will not interfere with the raising or lowering of the aerial wires. Place wooden pins in the upper ends of the pipes, and screw on them high tension insulators. Fasten a small pulley to these insulators with short pieces of seagrass line, and run sufficient ¼-in. bell cord through the pulleys to raise and lower the aerial wires. The distance between the masts will be governed by the size of roof, etc.; the greater this distance the better.

Cut from some well seasoned oak, two pieces 1¼ in. thick, 4 in. wide and 30 in. long and use them in suspending the aerial wires between the masts. Cut notches in these pieces as shown in Fig. 10, and tie four porcelain knobs to each of the pieces with seagrass rope. The knobs should have a play of at least 4 or 5 in. The four equally spaced notches should be used in preventing the ropes from slipping along the wooden pieces. A good size porcelain knob should be tied in the center of a piece of seagrass rope about 4 ft. long, and the ends tied around the wooden stretchers where the remaining two notches are cut. One end of the ropes that pass through the pulleys on top of the poles should be tied to this porcelain knob.

Run some No. 14 gauge bare copper wire through the insulators fastened to the stringers, as shown in Fig. 10, and fasten the wire in place. Solder a piece of No. 14 gauge copper wire to the points P and P_1, Fig. 10. In the center of this piece, solder another piece that will lead into your instrument.

The lead-in wire should be made as clear as possible, and by that is meant to use just as few insulators as you can conveniently get along with, since each tends to dissipate a certain part of the high-tension current and thus greatly lowers the efficiency of your sending or receiving. The wire should be well taped and passed through a heavy porcelain tube where it goes through the wall, or a better way still would be to drill a hole in the window pane and pass the wire through it.



Details of a Telegraph Key, Switch and Aerial

(To be continued.)

New Way to Remove a Bottle Stopper

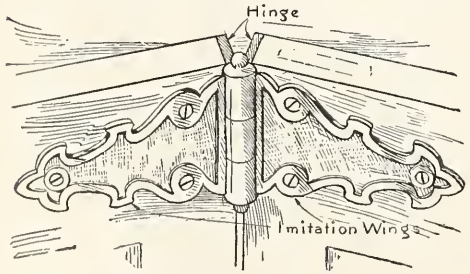
Take a bottle of liquid, something that is carbonated, and with the aid of a napkin form a pad which is applied

Removing the Stopper

to the lower end of the bottle. Strike hard with repeated blows against the solid surface of a wall, as shown in the sketch, and the cork will be driven out, sometimes with so much force that a part of the liquid comes with it and deluges the spectators, if desired by the operator.

Imitation Fancy Wings on Hinges

The accompanying sketch shows how I overcame the hardware troubles when I was not able to find ready-made hinges in antique design for a mission sideboard and buffet. This method allows a wide range of designs, which

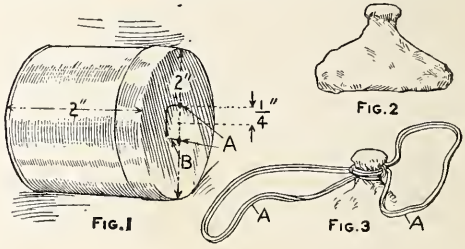


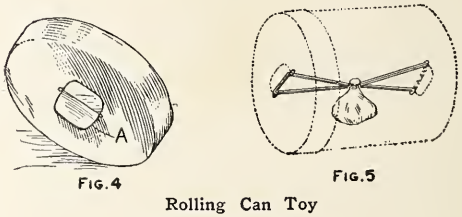
Fancy Hinge Wings

can be made at home with ordinary tools. The wings are made of copper or brass and finished in repoussé, or can be tarnished and the high places burnished with 000 sandpaper or steel wool, then lacquered with white shellac or banana bronzing liquid.—Contributed by John H. Schatz, Indianapolis, Ind.

How to Make a Child's Rolling Toy

Secure a tin can, or a pasteboard box, about 2 in. in diameter and 2 in. or more in height. Punch two holes A, Fig. 1, in the cover and the bottom, ¼ in. from the center and opposite each other. Then cut a curved line from one hole to the other, as shown at B. A piece of lead, which can be procured from a plumber, is cut in the shape shown in Fig. 2, the size being 1 by 1⅛ by 1¼ in. An ordinary rubber band is secured around the neck of the piece of





Rolling Can Toy

lead, as shown in Fig. 3, allowing the two ends to be free. The pieces of tin between the holes A, Fig. 1, on both top and bottom, are turned up as in Fig. 4, and the ends of the bands looped over them. The flaps are then turned down on the band and the can parts put together as in Fig. 5. The can may be decorated with brilliant colored stripes, made of paper strips pasted on the tin. When the can is rolled away from you, it winds up the rubber band, thus storing the propelling power which makes it return.—Contributed by Mack Wilson, Columbus, O.

Wood-Working for Beginners

By IRA S. GRIFFITH

Chapter VIII

Squaring Up Rough Stock

The process of squaring up rough stock—stock which has not passed through the mill planer—is not so very unlike that for squaring up mill-planed stock. The main differences, however, are very important.

Leveling or Truing the First Broad Surface

Level up one of the broad surfaces for a face side, taking off as few shavings as possible. A level surface is one of which all points lie in the same plane. To level a surface, therefore, means to plane off the high places. Figure 42 shows a surface "in wind" or not level or true, also, a true surface.

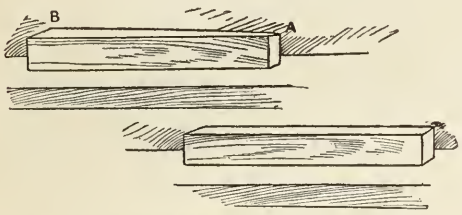


Fig. 42—Winding and a True Surface

There are several ways of testing a surface to find whether it is true or not. An experienced mechanic would probably find the eye sighting test sufficient. This consists in closing one eye and sighting with the other along the length of the piece for straightness, Fig. 43. Another test is to sight across the piece to see whether the front arris and back arris line up, i. e., whether they lie in the same plane, Fig. 44.

A beginner will find it advisable to use the following test in addition, until his eye has become trained in detecting inaccuracies. This test is used by mechanics when great accuracy is desired. It consists in testing for wind by means of winding sticks and in testing for straightness of length and width by

Fig. 43—Testing for Straightness

means of a straightedge. Testing for a wind, Fig. 45, is made by placing two straight sticks, having parallel edges, across the piece near the ends and sighting (with one eye) across their top arrises. If the surface is in wind, the arrises will appear as in A, Fig. 46. If not in wind, the arrises of the sticks will appear parallel as in B, Fig. 46. The straightedge test for length is similar to that for the edge, Fig. 33. In Fig. 47 is shown the straightedge test across the grain.

A substitute for the winding stick test, on pieces of some width—three or more inches—consists in placing the straightedge along the two diagonals.

Fig. 44—Testing for Twist

The straightedge test for length and width must be given as usual, in addition to the diagonal test. These tests

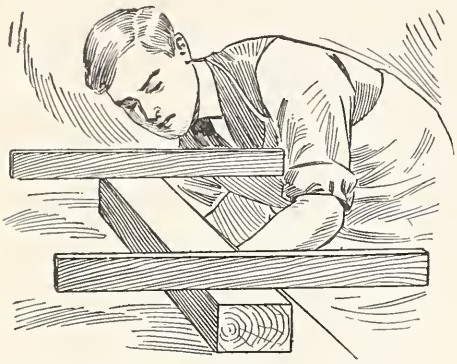


Fig. 45—Sighting for Winding of Surface

will show where and how much is to be planed and will need to be made frequently as the planing proceeds.

If the piece is in wind, two diagonally opposite corners will appear high. Plane diagonally across the piece until these corners are roughly leveled. It may be that the middle is on a level with these corners and the other two corners are low with reference to the center of the board. In this case, the diagonal planing will take the middle down as well as the two high corners.

Fig. 47—Testing Across the Grain

Finish by planing parallel to the grain, so as to leave a smooth surface. Put on the face mark.

Planing the First Edge

Straighten and square one of the edges for a face edge. This is done in the same way as for stock S-2-S, described in the preceding chapter.

The directions for gauging to width are the same as those given in a preceding chapter, also planing for the second edge.

Gauge to Thickness

Since rough stock is variable in thickness, it will be necessary to set the marking gauge to the thickness wanted and mark sharp lines, one each on the two edges. Keep the head of the gauge against the face side in so doing.

Planing and Testing Second Surface

Since the face side was leveled and the thickness gauged from this, the sec-

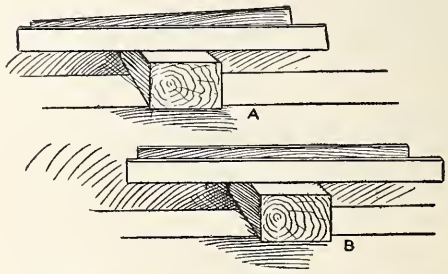


Fig. 46—Showing a Winding and a True Surface

ond surface ought to be level and true, if the planing is made to stop at the gauge lines on the two edges and if the middle of the board is neither high nor low with reference to these lines. To see whether the middle is high or low, place the straightedge across, as in Fig. 47, and test at a sufficient number of places to show the true condition. This test must be made frequently while approaching the lines, that the surface may be level when the lines are reached —at least not low in the middle, for there would be no remedy for that without decreasing the thickness below what is desired.

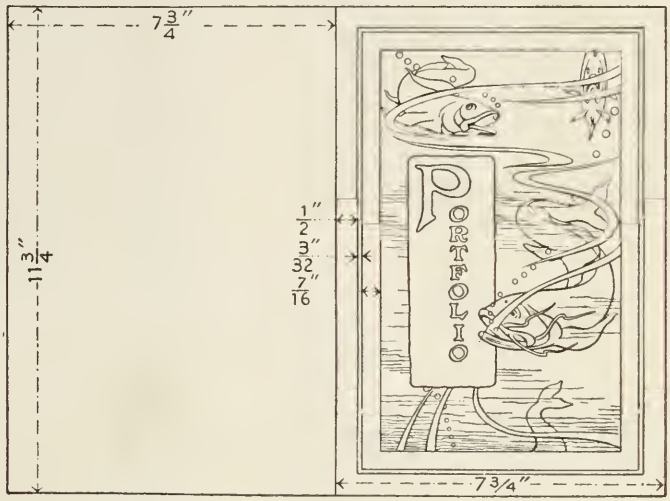
The directions for planing first end, measuring length and lining and planing second end will be found in preceding chapters under the same heads.

(To be continued.)

How to Make a Portfolio

Secure a piece of Russian modeling calf leather of a size equal to 12 by 16 in. Make a paper pattern of the size indicated in the accompanying drawing, putting in the design.

The necessary tools consist of a stick with a straight edge and a tool with an end shaped like that of a nutpick. A nutpick with a V-shaped point will do if the sharpness is smoothed off by means of a piece of emery paper, so that it will indent without cutting the leather. These tools can be bought for this special purpose, but are not essential for this piece if the nutpick is at hand. There will also be needed a level, non-absorbent surface upon which to lay the leather while working it. A piece of thick glass, metal, or marble will serve.



Portfolio Design

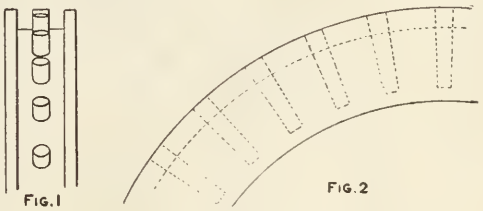
Begin work by moistening the leather on the back side with a sponge or cloth. Moisten as much as you dare and still not have the moisture show on the face side. Next place the leather on the glass, face up, and, holding the pattern firmly in place so that it will not slip—if possible get some one to hold the pattern for you—place the straight edge on the straight lines and mark out or indent. After this has been done, mark over the design. A pencil may be used the first time over.

The pattern is now to be removed and all the lines gone over with the tool to make them deep and uniform.

The surplus stock around the edges may not be cut off. A neat way to finish the edges is to punch a series of holes entirely around through which a thin leather thong may be laced. If it is desired to "line" the inside, this should be done before the holes are punched or the lacing done.

Gear for Model Work

When a gear is needed to drive a small pinion and there is none of the right size at hand, one can be made in the following manner: Turn up a wood disk to the proper diameter and ¼ in. thicker than the pinion, and cut a flat bottom groove $\frac{3}{16}$ in. deep in its face. The edges should be about ⅛ in. or more thick on each side. Measure the distance between centers of two adjacent teeth in the pinion and step this off around the periphery in the bottom of the groove. Drill holes into the wood on each point stepped off and insert steel pins made of wire, allowing the end of each to protrude just far enough to act as a tooth. In this way a good gear for light work can be quickly and cheaply constructed.—Contributed by Henry Schaefer, New York City.



Steel Pins in Wood

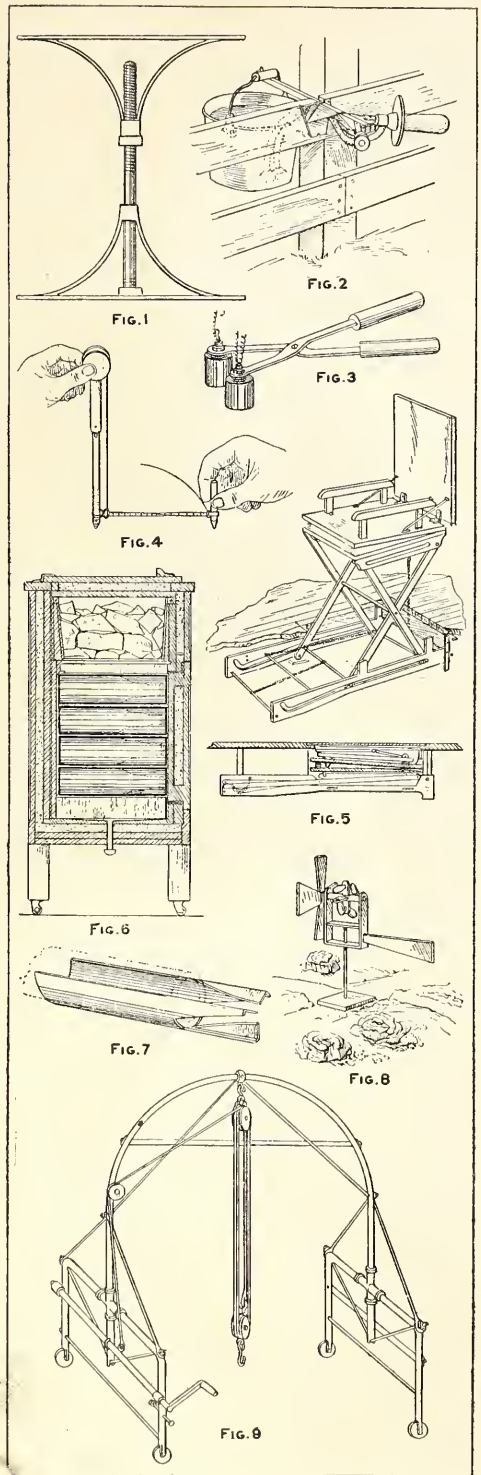


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

INTERESTING PATENTS,

ADJUSTABLE SHELF SUPPORT—An adjustable shelf support, of the order illustrated by Fig. 1, is often found very useful. By turning the nut, the upper bracket is raised or lowered to suit the re quirements.

SIMPLE FEEDER FOR CALVES—Feed tubes, nipples, a metal support, and an ordinary pail, assembled as shown by Fig. 2, provide a simple portable feeder for calves. A notch is cut in one of the boards of the fence or other obstruction forming the enclosure in which the calves are kept, and the support is made fast over this notch. The feed tubes leading from the bottom of the milk pail to the nipples, pass through the notch, protected by the metal of the support.

ELECTRIC GARMENT CREASER—Figure 3 is an easily operated electric device for the creasing of trousers or other garments. The rollers at the ends of the pivoted arms are provided with electric resistance coils as a means of heating them. The coils can be connected with a flexible wire attachment to any ordinary electric light socket.

DEVICE FOR MEASURING AND DRAWING ARCS—A device designed for measuring and drawing arcs is illustrated in Fig. 4. It consists of a tape holder mounted at the top of a center tube. The tape passes from the holder down the outside of the tube to a ring guide near the base. The marker is attached to the end of the tape, which is pulled out the required distance to make the desired arc. A finger piece on the holder prevents the tape unwinding when pressure is exerted against it.

AUTOMATIC FOLDING CHAIR FOR THEATERS AND AUDITORIUMS—An automatic folding chair, which folds into the floor the moment the occupant arises from it, is illustrated in Fig. 5. When the chair folds down, its back fits into the opening in the floor, closing the opening in the manner of a trap door. The chair is designed for use in theaters, churches, convention halls, and like places where large numbers of people congregate. Its main object is to instantly clear away all obstructions to rapid exit in such emergencies as fire. The method of automatic operation is as follows: The folding side arms and back are secured to the seat by hinges provided with springs. The occupant of the chair pushes the back up, opens out the arms, and sits down, the pressure on the seat keeping the arms and back in place. When the pressure is removed from the seat, the springs are released and the arms fold down. This movement of the arms operates in turn on the braces holding the chair extended, and the whole sinks into the floor.

REFRIGERATOR FOR THE COOLING OF BOTTLED LIQUIDS—A small, compact refrigerator has been designed for cooling bottled liquids (Fig. 6). The ice receptacle is in the top, as in the majority of portable refrigerators, beneath which is a series of horizontally disposed holders for bottles. The water produced by the melting ice drips over the bottle holders, and finds an outlet at the bottom. If rapid cooling is required, the ice is broken into small pieces and salt is added.

SHOT SPREADER—A shotgun attachment designed to spread the shot is illustrated by Fig. 7. It consists of a split member, formed to grip the muzzle end of the barrel, and provided with shot spreading vanes extending forward, the inner edges of which are flared downwardly toward the muzzle end of the gun.

A WINDMILL SCARECROW—A new form of scarecrow (Fig. 8) is built on the lines of the toy windmills. The whirling of the wind wheel operates clappers, which are expected to make a noise to scare away the birds. The greatest drawback to the idea seems to lie in the fact that it will not operate when there is no breeze.